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The AIRCRAFT ENGINEER

First Aeronautical Weekly in the World : Founded 1909

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The Outlook

464 *M.P.H.*

THE world has heard with some astonishment of the new speed record over the 3-km. course established by the German pilot Dieterle. By this flight not only has the record over the 3-km. course been beaten by a wide margin, but also the speed over the 100-km. course, and even the out-and-out speed record previously held by a seaplane.

Until it has been homologated by the F.A.I. the flight will not, of course, rank as an official record, but there is no reason to doubt that it will be homologated, and aviation circles all the world over will be united in paying tribute to German technique and German skill. Herr Dieterle, no less than the Heinkel and Mercedes-Benz companies and the German Air Ministry, may be sincerely congratulated on what all will concede is an extremely fine achievement.

Expressed in figures, the new record (for so we may term it at once) has beaten the previous 3-km. record by 84 m.p.h. That was established in November, 1937, by Hermann Wurster on a Messerschmitt BF.113 monoplane with DB 600 engine. General Major Udet, on a Heinkel He 112 U, from which Dieterle's machine seems to have been developed, averaged 394 m.p.h. over the 100-km. course in June, 1938. And the seaplane speed record was held by the Italian pilot Francesco Agello, who as long ago as October, 1934, averaged 440.7 m.p.h. on a Macchi-Castoldi seaplane.

To view the German achievement in its proper perspective it is necessary to bear in mind that the statements in the newspapers are to be accepted with a certain amount of reserve. For instance, one need not take too literally the reference to a single-seater fighter being used, nor is there any need to jump to the conclusion that Germany now has fighters which will do 464 m.p.h. If it did start life as a fighter design it may be taken for granted that the actual machine used had had its wing area reduced and had been cleaned up generally and the surfaces of wings and fuselage given a glass-smooth polish. The reference to an engine of 1,175 b.h.p. obviously refers to the rating of the normal engine. Doubtless the racing engine had been speeded-up, its degree of ground boosting increased by using a special doped fuel, and probably it was developing more than 2,000 h.p. That in no way detracts from the achievement, but it should be borne in mind and allowed for.

The Large Flying Boat

"WHATEVER is the limiting load which can reasonably be taken off the surface by an aircraft, this load can always be increased when the machine is flying. If the major part of the fuel is not added until the aircraft has taken off, its weight may be largely replaced by pay-load." At first sight this sentence may appear to be one of those described by *Punch* as blinding glimpses of the obvious. Actually, it is not quite that, as a perusal of the article on pp. 342-344, from which the sentence is quoted, will show.

Flight is very glad to extend the hospitality of its columns to the technical staff of Sir Alan Cobham's company for the purpose of stating the case for refuelling in the air. We have in the past given due prominence to the claims of the Short-Mayo Composite, and we are prepared to do the same for any system or device which promises to increase the range or pay-load or both of civil and military aircraft. We have no personal preferences for any particular system because we feel that there is room for them all. One will offer the best solution in one particular set of circumstances. If the conditions of operation are different, another solution may prove the better.

From the civil point of view one of the three main classes of "artificially" increasing the range seems to be ruled out by fundamental considerations. We refer to the catapult type of launching. Unless the track to

be provided can be made very long indeed, the acceleration is likely to be of an order which the fare-paying passenger can hardly be expected to accept. But that is not to say that catapulting will not have its uses. In fact, this form of take-off assister was in extensive use before any of the others were tried out. It has and will continue to have its obvious uses, not only for military aircraft but very possibly for long-range mailplanes when we come to use them.

We think that Sir Alan Cobham's staff have made out a good case for refuelling. An increase in pay load of 41 per cent. is not to be despised, and would be sufficient to make the difference between a route paying its way and not paying.

A Base Question

SINCE the Air Ministry finally decided that Southampton Water should be the base for the Empire flying-boat services, and the original Langstone Harbour scheme was opposed, apparently with finality, by the Admiralty, various other schemes have been suggested and given due prominence from time to time.

Not unnaturally, people want to know why the Air Ministry has so far made no decision about one or other of these schemes. It is known that Imperial Airways, though deprived of Langstone Harbour, still prefer the "round pond" idea, in which an artificial stretch of water, with an adjoining landplane airport, is arranged at some meteorologically and commercially convenient spot. At the moment the Pagham Harbour plan appears to be that most favourably considered, and certainly Imperial Airways hope that they will not be forced to use Southampton Water for an indefinite period.

There were and are certain disadvantages in the Langstone scheme and the Admiralty's objections were probably fully justified. In the first place, it is not very satisfactory to have an important and busy air base within, so to speak, a stone's throw of a major naval base, while the presence of a prohibited area in the district would be a cause of difficulty in bad weather, and the activities at the nearby Thorney Island R.A.F. aerodrome might offer at least minor danger.

Other alternatives to the Pagham Harbour site include one to the south-east of Southampton airport itself, where Mr. Payne, the airport manager, has discovered a suitable area of low-lying ground which could very easily be flooded with the aid of local streams. This area would give ample runs in all essential directions and would not be very expensive to lay out. There are likely to be certain engineering difficulties, but these should not be unsurmountable.

Amidst all these suggestions and counter-suggestions, the Air Ministry remains silent. The immediate conclusion to be drawn is that the Treasury itself is proving adamant and no money is at present available for air base development work on a large scale. The Treasury probably feels that the temporary Southampton base has proved to be reasonably satisfactory. There have been no mishaps during the period in which it has been in use and until one of the Short boats, in fact, rams the *Queen Mary*, nothing at all is likely to be done. Possibly even some of the libellous rumours surrounding the air base position have some foundation of fact, but at any rate the Air Ministry ought to explain its attitude.

In the meantime, one cannot help wondering what is the objection to building a special base at Pagham or elsewhere and to going to the public for the money. To obtain this money it would only be necessary for the Government to guarantee the interest for a reasonable number of years, after which the base might be expected to begin to pay for itself. If it is imagined for a moment that the initial cost would be a million pounds, the interest at 4 per cent. would be no more than £40,000 a year. Presumably even the Treasury could afford this sum—which would be reduced year by year as suitable landing fees were taken.

Of Man's Estate

APRIL 1 is a date which generally raises a smile, but it is, none the less, the date on which all important administrative changes in the British Empire come into force. So on April 1, 1918, the Royal Air Force came into being. Those of us who were in the R.N.A.S. or R.F.C. at that date felt puzzled and did not quite know where we stood. However, it meant a new type of uniform, and every Service man loves to wear something different from other corps, even though it be but a new pattern of khaki. To the R.N.A.S. the khaki was a novelty, and the Lieutenants in that Service were delighted to find themselves denominated Captain.

Little more than seven months of warfare then lay before the new Service. Now, twenty-one years later, the R.A.F., in common with the other Services, is increasing its fighting ability with remarkable celerity in view of the thunder cloud which lies over Europe. In those years of infancy a tremendous amount of organisation and development has been done, and much thought has been given to air tactics and air strategy. The R.A.F. is no more a child, but a strong man armed. *Flight* wishes it "Many happy returns of the day."

FASTEST ON THE LEVEL: Flight Captain Dieterle in the specially prepared Heinkel in which he is claimed to have covered 3 km. (1.86 miles), at a speed of 463.8 m.p.h. Presumably—though confirmation is unobtainable—this was a two-way mean speed. The engine is a Daimler Benz inverted vee-twelve of unknown horse-power, but certainly delivering more than the 1,175 h.p. quoted in the Press.

TRACTIVE EFFORT : Capt. J. H. Cordes retracts the undercarriage of a Hampden as he passes—on the L.M.S. line skirting Handley Page's Radlett Aerodrome—a "Garratt" type locomotive, which is capable of a tractive effort of 45,620 lb. The combined take-off output of the Pegasus engines of the Hampden is between 1,900 and 2,000 h.p.

The Cities and Their Squadrons

THE linking of R.A.F. squadrons with cities may be taken as a birthday present for the R.A.F. Over fifty cities have now adopted a squadron as their own, and mutual visits and other friendly gestures are to follow. It is a happy thought, for in the Army the territorial names of regiments have done much to foster *esprit de corps* and fighting spirit. The Auxiliary squadrons have always been on a territorial basis, but the regulars have had no spur to their *esprit de corps* other than a number and the memory of what that number had meant to airmen during the Great War. To the public a number does not suggest an entity with a proud fighting spirit; it is merely a mathematical expression rather difficult to remember. This affiliation will go a long way to give life and meaning to the numbers.

It would have been better still if things had been carried a little farther and a squadron had been allowed to carry the name of the city to which it is affiliated; but that may come. Incidentally, where a squadron is re-equipped, its civic patrons will presumably not be allowed to visit it until six months have passed, lest a foreign agent be told what he can see for himself by looking over the aerodrome wall.

DIARY OF FORTHCOMING EVENTS—Page 364

Delays in Air Mails

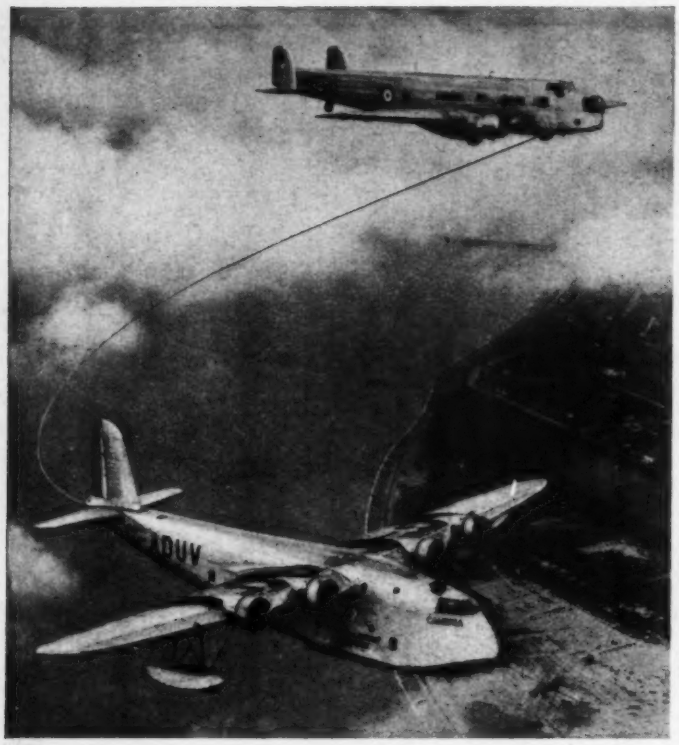
IN the bad old days when Air Conferences used to be held every year at the Guildhall, constant appeals were regularly made to the General Post Office to support the cause of flying by granting mail contracts. The conferences were always attended by the late Sir Frederic (then Brig. General) Williamson and his reply always took the line that the G.P.O. would do so as soon as aircraft could guarantee regularity, but that it preferred reliability to erratic speed.

The Empire air scheme introduced in the last few years was based on the supposition that air lines now were reliable (and so far as the qualities of the engines go they ought to be quite reliable) and therefore all letters along the Eastern and Africa routes are now sent by air. Yet complaints are coming to hand from both Sydney and the Cape to the effect that British mails are late in arriving, not only occasionally but far more often than they ought to be. Figures published in Sydney show that between July 19 last year and February this year forty-four British aircraft arrived on time but forty-two were late by one day or more. The record of the K.L.M., we are informed, was very much better.

A correspondent of the *Daily Telegraph and Morning Post*, writing from Cape Province, complained recently, not of late arrival of the mailplanes, but of late delivery of letters. The burden of his complaint was that there was no guarantee that a letter would travel by any particular mail even though posted in good time. This may be due to faulty organisation by the G.P.O. or to shortage of aircraft or to a combination of both.

In both cases the only real cure would seem to be the use of special mailplanes. It does not matter much if passengers arrive rather late, provided they arrive safely, but mails ought to be delivered on time.

THE LARGE FL



THIS article, with its diagrams, has been contributed by the Technical Staff of Flight Refuelling, Ltd. Under the leadership of Sir Alan Cobham this firm has, for a considerable time, been conducting aerial refuelling research for the Air Ministry. In the photograph above, the Empire boat "Cambria" is seen coupled up by a fuel line with the A.W. XXXIII used by Flight Refuelling in their experiments from Ford Aerodrome.

BEFORE the Lilienthal Society for Aviation Research, on October 12, 1938, Igor Sikorsky read a paper entitled "Trends in Design of Large Flying Boats."

In the first half of his paper this well-known authority on marine aircraft compared flying boats with landplanes, and showed that, whereas the landplane had advantages in speed, range and carrying capacity in small and medium sizes, it had lost its advantage when one came to machines of 100 tons all-up weight.

He has concluded this part of his paper by saying (according to *Inter Avia*):—

"Not long ago many experts of aeronautics predicted that an increase in size would be followed by an unproportional increase in structural weight, and therefore, a loss in range and load-carrying efficiency. As a reason for this, the so-called Law of Squares and Cubes was mentioned (change of lift efficiency with area, as the square of the scale; change of the structural weight with the volume, as the cube of the same figure). Such comparative investigations are, however, in the opinion of the lecturer, more a problem of the practical aircraft designer than of the scientist. In order to be efficient, the large aircraft must differ from the smaller machine in fundamental design features and proportions. Therefore, any analysis based on the study of a proportionately enlarged design would be misleading, and to obtain a solution of the problem it is necessary to study a series of designs, each of them, therefore, being substantially different.

"It is not a coincidence that responsible aircraft designers (in America) are ready to undertake construction of 100-ton flying boats, and to guarantee performances considerably in excess of what could be expected in smaller boats of any type. In general, the author believes that limitations in the size and weight of flying boats will come from traffic requirements and economic factors, and not from engineering difficulties. On the other hand, the largest landplanes will remain substantially below the size and weight of flying boats owing to the increase in weight of landing gears and the limitations in size and wing loading of landplanes set by the size of the airports."

This interest in the 100-ton flying boat is claimed by *Aero Digest* to have arisen from a specification issued by Pan-American Airways in December, 1937, in which they asked for tenders for the construction of a machine having a pay-load capacity of 25,000 lb., a range of 5,000 miles in still air, and a cruising speed of 200 m.p.h. at sea-level. European interest has also been aroused in the large flying boat, and the problem is known to be under consideration in Great Britain, France and Holland.

Before going on into the second part of Sikorsky's paper, attention should be drawn to the last sentence in the quotation above; that in which he said: ". . . the largest landplanes will remain substantially below the size and weight of flying boats owing to the increase in size of landing gears, and the limitations in size and wing loading of landplanes set by the size of the airports."

This problem has already begun to be serious, and it has led Douglas, in the design of his D.C.4, to go back to higher-pressure tyres than have been customary in recent years. Whilst this move helps in the design of the actual aeroplane itself, by allowing the use of a smaller and lighter wheel, it may introduce serious difficulties if the D.C.4 is used on airports not having concrete runways.

A study of the weights of a well-known make of intermediate-pressure tyres and wheels in relation to the load which they will carry shows that their weight is going up much faster than the load they can bear (see Fig. 1). One must, therefore, agree with Sikorsky that the undercarriage will probably limit the size of aircraft which can be operated from an aerodrome.

The Limiting Weight

There is, however, one other point which he has not considered. When that limit of size has been reached it is still possible to add the greater part of the fuel after the take-off, by the methods of Flight Refuelling. Therefore, the limiting weight is the maximum possible on the ground plus 90 per cent. of the fuel weight. An additional pay-load equivalent to this fuel weight can then be taken on board. Incidentally, it is probably necessary to have 10 per cent. of the total fuel on board at the take-off to carry the aircraft until it has been refuelled. For an aircraft having an endurance of 20 hours this would be equivalent to over one hour at climbing consumption.

Having shown that for large aircraft the flying boat may have greater efficiency than the landplane, Sikorsky gives some particulars of a boat of 210,000 lb. all-up weight, the design of which he has developed:—

Gross weight	210,000 lb.
Wing and tail, 14.4%	(=30,250 ,,)
Power plant, 15.3%	(=32,100 ,,)
Boat hull and floats, 10.0%	(=21,000 ,,)
Controls, instruments, and electrical equipment, 1.95%	(= 4,100 ,,)
Furnishing, 11.9%	(=25,000 ,,)

FLYING BOAT and AIR REFUELLING

Some Observations Prompted by the Opinions of Igor Sikorsky

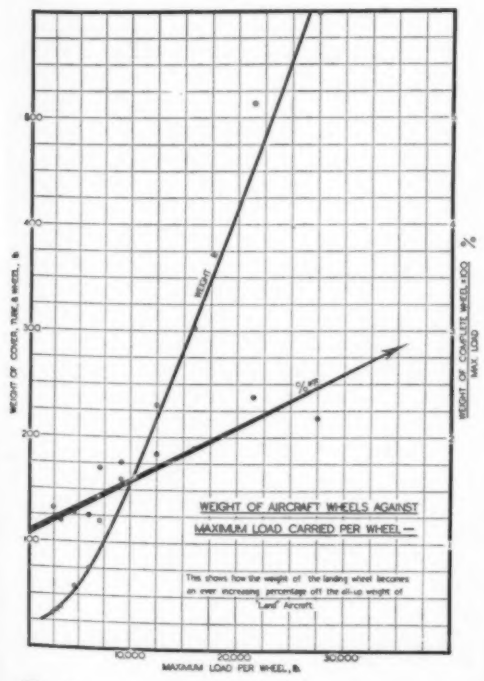
Power plant weight lb/h.p., 2.68	(=12,000 B.H.P. max.)
Furnishings per passenger	250 lb.
Passenger capacity	100
Range	4,350-5,000 miles
Cruising speed on 50% max. B.H.P.	187 m.p.h.
Wing loading ..	45 lb./sq. ft. (: wing area = 4,666 sq. ft.)

(The figures in brackets are calculated from the information given.)

After some discussion of various features of the design, Sikorsky is reported by *Inter Avia* as saying:—

"The assisted take-off has, in the opinion of the lecturer, no justification for aircraft of 40 tons and more, as the modern traffic and structural requirements—high cruising speed with great power reserve (about 300 km/h at about 50 per cent. of the available take-off power); reasonable landing speed with 70-80 per cent. of the gross weight; structural requirements resulting from large wing span; limitation of wing loading by these reasons; determination of power loading by requirements for high cruising speed—demand, apart from the take-off procedure, such qualities from the flying boat as will enable it to take off under its own power. These conditions are different in the case of much smaller planes, so that the assisted take-off may offer sufficient advantage to justify its use.

"Incidentally, it may be expected that in flying boats, with comparable wing and power loading, the take-off characteristics improve as the size increases; first, scale effect favours bigger craft in regard to drag in the air and on the water; second, which is still more important, in the bigger craft—as far as the boat hull is being increased exactly in proportion to the cube root and the wing loading only to the fourth root of the gross weight—the most critical moment of the acceleration, namely, the passing over the hump or over the moment of maximum water resistance, occurs at a much greater speed; in other words, at a time when the wing will carry a greater proportion of the weight. Therefore, in large flying boats heavier power loadings could be employed It is thought probable that with the wing and power loadings discussed above, the large flying boats would have excellent take-off characteristics, thus eliminating the necessity of artificial take-off methods in commercial air traffic."


WEIGHT OF COVER, TUBE & WHEEL, lb
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%
MAXIMUM LOAD PER WHEEL, lb
10,000
20,000
30,000
WEIGHT OF AIRCRAFT WHEELS AGAINST MAXIMUM LOAD CARRIED PER WHEEL—
This shows how the weight of the landing wheel becomes an ever increasing percentage off the all-up weight of Land Aircraft.

Fig. 1.

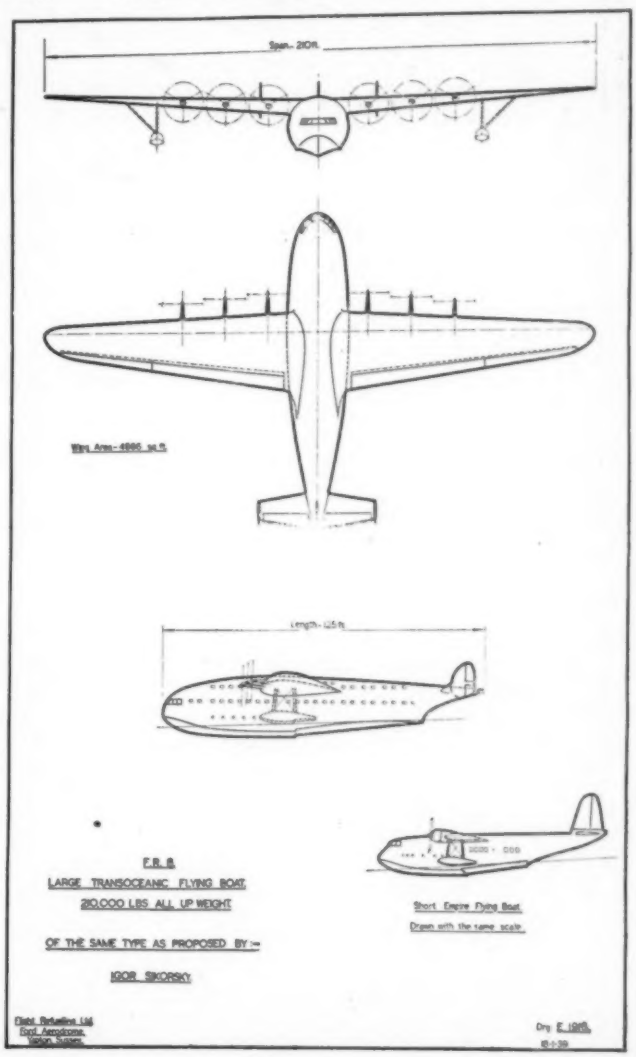


Fig. 2.

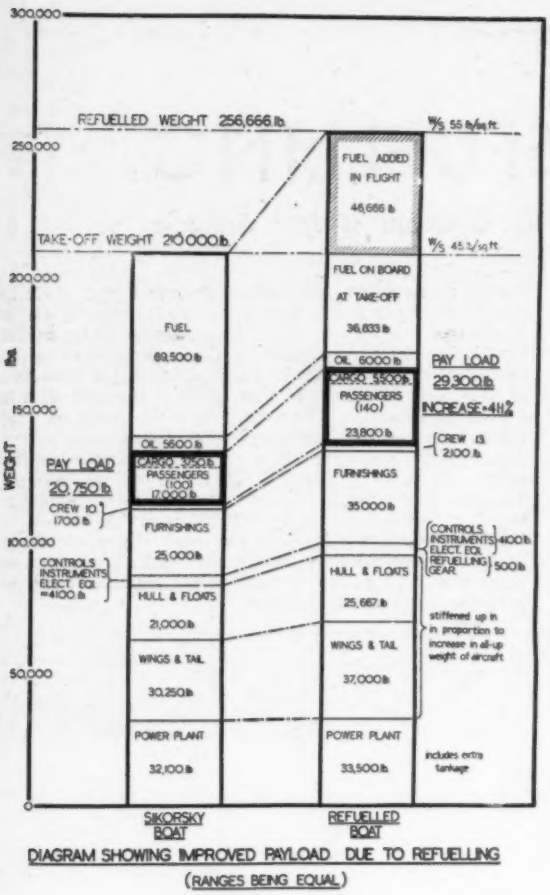


DIAGRAM SHOWING IMPROVED PAYLOAD DUE TO REFUELLING
(RANGES BEING EQUAL)

Fig. 3.

Whilst we agree with Sikorsky's justification for the value of assisted take-off in smaller flying boats, we cannot accept his reasoning as applied to the larger boat. Given that his boat will take off with 100 passengers on 12,000 b.h.p. and that its range will be 5,000 miles at a cruising speed of 187 m.p.h., we have investigated the improvement in revenue-earning capacity made possible by refuelling in flight. The improvement, as will be shown below, is remarkable, and we can only assume that Sikorsky was thinking of other methods of assistance, such as catapulting, which lacks the flexibility and danger-free characteristics of refuelling.

It is not sufficient to say that here is a boat capable of crossing the Atlantic with a pay-load. If it were possible to increase that pay-load very considerably with no increase in the size of the boat or engines, then this possibility should be thoroughly investigated.

Taking the figures published, and a rough sketch which appeared in *Aero Digest*, we have endeavoured to reconstruct his design, as shown in Fig. 2. Our performance calculations agree exactly with the cruising speed which he quotes.

In specifying 50 per cent. max. b.h.p. as the cruising condition, Sikorsky has evidently been considering not only the overhaul life of the engines, but also the most economical speed for long range. The boat shown in Fig. 2 would cruise at 210 m.p.h. on 60 per cent. power, but its pay-load would be reduced by 18 per cent. on an Atlantic crossing from Southampton to New York, and it is reasonable to assume that the Sikorsky boat would be similarly affected.

A comparison between the two cases is shown in Fig. 3. The left-hand diagram gives the analysis of the weight of the Sikorsky boat as it would be for a direct crossing of the Atlantic between Southampton and New York (3,750 miles+300 miles reserve) against a 40 m.p.h. headwind. The cruising speed is taken as 187 m.p.h. on 58 per cent. max. b.h.p., and the figures are all based on those published by Sikorsky.

The right-hand diagram gives the weight analysis of a similar boat which is taken off the water at the same loading as the Sikorsky, but refuelled in the air to 256,666 lb. It is cruised on 60 per cent. max. b.h.p. at a speed of 187 m.p.h., the larger power for the same speed being explained by the higher induced drag at the heavier loading. The pay-load is increased by 41 per cent. The ton-miles per gallon are increased from 3.75 to 4.35.

The specific fuel consumption in each case is assumed to be 0.42 lb/b.h.p./hr., and the oil consumption 20 pints per hour per engine+50 per cent., i.e., a total of 22.5 gallons per hour.

The structure weight has been assumed to increase in proportion to the all-up weight, a pessimistic assumption, and a very generous allowance has been made for extra tankage and for the refuelling equipment that would be required.

It might be argued that the boat would be crowded by the addition of 40 more passengers. It is probable, however, that Sikorsky's figure of 12.5 cubic metres (=441 cubic feet) per passenger was arrived at by dividing the hull size (decided by hydrodynamic and aerodynamic requirements) by the maximum number of passengers which his restricted pay-load allowed. In using the same space for 140 passengers we still have 315 cubic feet per passenger. This should be very adequate for an Atlantic crossing of a little over 24 hours, and the accommodation is luxurious by comparison with that provided on trans-Continental trains, in which passengers may be confined for several days.

74 per cent. More Pay Load

If the refuelled weight were increased to 280,000 lb. and the cruising power to 66 per cent. max. b.h.p., the speed would be increased to 190 m.p.h. and the pay-load by 74 per cent. This, however, might present some problems in capacity unless the hull were redesigned to suit it.

Summing up, it may be said that whatever is the limiting load which can reasonably be taken off the surface by an aircraft, this load can always be increased when the machine is flying. If the major part of the fuel is not added until after the aircraft has taken off, its weight may be largely replaced by pay-load.

If Sikorsky had so designed his boat that it could have taken off with more than 210,000 lb.—that is to say, if he had given it a lower power loading—then equally it could have been given a larger overloading. The same is true of any aeroplane or flying boat having a reasonable relationship between wing loading and power loading.

Flight Refuelling, Ltd., try to make it one of their basic principles that a transport aeroplane or bomber, at the end of its useful life in that capacity, may still be converted into a tanker to refuel the next generation of transports or bombers. Thus an Empire Boat may eventually be converted into a tanker for the next larger and speedier flying boat which succeeds it. The Sikorsky S.42 Clipper would probably be still useful to tank-up the Boeing 314 when its useful life as a transport is over. In its turn the 314 could eventually refuel the next generation.

The Sikorsky 100-ton flying boat, however, makes such a tremendous step forward that this principle may not entirely apply. Since, however, the new boat is as yet only hypothetical, it might be worth seriously considering whether these particulars should not be taken into account in its design. If the pay-load which Sikorsky quotes is a specified one rather than the larger pay-load which we have estimated, then a smaller refuelled flying boat could be used to carry it. In this case the Boeing 314 would probably prove adequate.

The larger the aircraft the longer does its development take, and it is improbable that we shall see such machines in service until the generation of the Boeing 314, now entering on its useful life, has attained middle-age at least.

Taking into account every aspect of the position, we find it difficult to believe that Sikorsky was thinking of refuelling when he said that assisted take-off had no justification for large flying boats.

OVER SAN FRANCISCO BAY : One of the 1939 four-seater Cessnas—actually the company's photographic machine—with a typically Californian crystal-clear background. The new Cessna carries a useful load of 1,000 lb. with a gross weight of only 2,350 lb., and has a top speed of 162 m.p.h. ; it is fitted with a Warner Scarab engine of 145 h.p. The agents in this country are Aviation Corporates.

Topics of the Day

New Ideas in Power Units

SINCE the earliest days of the internal combustion engine—and certainly since the flying machine became a moderately useful means of conveyance—people have been anxiously waiting for the arrival of some more suitable form of power unit. In the meantime hundreds of inventors have expended their energies and money over periods of years on different variations of the heat engine, and such things as swash-plate motors, i.c. turbines, and sometimes extravagantly ingenious valve gears have been tried and usually found wanting.

Just at the moment (though perhaps this moment has always been with us) several very good ideas are in process of development. In spite of all the criticism of the theorists, the single-sleeve valve type of engine has now come into its own. This is interesting not so much because of the Bristol engine's intrinsic virtues but because the success of this type of valve has tended to give the lie to all those who talk so knowingly of heat dissipation and lubrication troubles.

Just the same criticisms have always been levelled at the rotary valve idea, and at least one patient engineer has, during the last decade, been struggling with the various problems involved. So far he has not gone far beyond the single-cylinder stage of development. Another engineer has devised a rotary valve of somewhat different and certainly ingenious design.

Though development inevitably is slow, this engine—the Aspin—certainly appears to produce results, and an American company which has taken a considerable interest in the design has already gone so far as to manufacture quite a few single-cylinder engines which they have sent round to their trade friends for test and comment. In England Mr. Aspin is working on one or two new and interesting multi-cylinder types, and has had a flat-four unit running for some considerable time. The more interested people in the aeronautical business may remember that this particular engine was due to be fitted to the unconventional Hillson Pennine. Unfortunately, the engine was not ready in time, and the Pennine, in any case, with its simplified control system, has since been regretfully put under a dust-sheet for the time being.

Those who understand the difficulties of internal combustion engine design may probably feel that any success which the prototype Aspin engines has achieved has been due largely to a lucky combination of design and manufacturing circumstances. The rotary valve in this case is a conical one, and a good deal depends on the shape of the ports, in the arrangement of the oil-retaining grooves, and, most important of all, in the more or less accidental amount of play in the thrust races. This play permits the oil film between the valve and its seating to reappear as the pressure drops.

But people still ask how it is that the designer can get rid of the tremendous amount of heat generated. After all, the rotary valve type of engine is always designed to run with fabulous compression ratios ; there are no hot spots and the plug, for instance, can be masked by the valve until the actual moment of firing. A figure of 14 to 1 is not an unusual one and the power output is consequently extremely high and the fuel consumption low.

The future of the Aspin engine remains to be seen. When something really big and useful has been built, presumably the world's engine manufacturers will begin to take a serious interest—though it is difficult to believe that these manufacturers are not carrying out experiments on their own.

Two in One

WHILE still retaining conventional valve arrangements, or, at least, the tried sleeve-valve system, there must be any amount of scope for original ideas in aircraft engine design. I have always felt, for instance, that the American Unitwin design is one with really basic and so

Topics of the Day

far largely unexploited advantages. In this design two in-line engines are coupled together through a form of clutch mechanism to a constant-speed airscrew, and either half, so to speak, can be uncoupled at will, after which the airscrew pitch is changed to suit the new power output and engine speed.

It would certainly seem that the H-section type of engine is admirably suited to the Unitwin idea. At the same time, and in order to deal with the colossal torque reaction of the very high-powered engines which are now being made or designed, such a crankshaft arrangement makes concentrically mounted and opposite rotating airscrews a practical proposition. Though what would happen if the particular side of the engine which is driving the leading airscrew gave up the ghost is another matter altogether. However, the fully controllable pitch and feathering airscrew at least brings the whole thing into the world of clear mechanical reason.

An Interesting Theory

AFTER pretending to be an aero engine engineer for a quarter of an hour I will now pretend for a moment to be an aerodynamic expert.

The other day I heard an interesting theory—reasonable on the face of it and certainly worthy of attention. We all know that one or two modern transport and military types with very high wing loadings, develop unpleasant and dangerous characteristics near the stall—particularly during the take-off.

Contrary to the general idea, the real danger may not be so much the result of high wing loading and wing design as such, but rather of comparatively low power-loading. In other words, such machines can be progressively less easy to control during the take-off as the all-up weight is reduced—the reason being that maximum power and full fine pitch is always given and there is, consequently, a tendency for the machine to fly largely on its engines alone.

This tendency makes it necessary for the pilot to be exceptionally careful about the trim of the machine, at least towards the end of his take-off run, and especially if the surface of the aerodrome is at all irregular. With the tail below the natural level-flight attitude the engines are tending to "helicopt" the machine into the air, and this effect is, of course, accentuated by ridges on the ground. Consequently, the machine may very easily fly up to a height of ten feet with the wing practically at the stall and the slightest variation in its direction, or changing wind eddy conditions, will cause a wing to drop.

While thinking of direct airscrew lift effects, designers who are all out to provide exceptionally short take-offs and slow, steep approaches with multi-engined machines have still got the Crouch-Bolas idea before them.

Whither Imperials?

GOING, for a moment, from technics to politics, I cannot help wondering where our national air transport company is heading.

Once upon a time it was near to paying its way—and was duly, if indirectly, castigated for such an offence against modern ideas. Now, it seems, the plan is to spend as much money as possible and, in fact, to give up all idea of eventual economic self-sufficiency. It is tending to become a sit-down Government concern with highly salaried figureheads about the place.

That is all very well, but we want to see results. If twice as much is to be spent on British air transport the taxpayer expects twice the service efficiency. Those who foot the bill are not interested so much in nice new terminal buildings or still nicer new posts with high-sounding names. They want to see aeroplanes flying and jobs of work being done. Heaven preserve us from a criticism-proof, spoon-fed concern run by armchair experts of different kinds. One or two of the new or about-to-be new employees should do some driving; so we'll see.

In the meantime, everyone is wondering about the Ensign position. Apparently Armstrong Whitworths consider that the machine can reasonably go immediately back into service as soon as constant-speed airscrews and modified ailerons have been fitted, while the Tiger IX^{c} has already completed a type test for re-rating at a take-off power of 935 h.p.—which is 55 h.p. more than the original maximum. On the other hand, it is freely rumoured that Imperial Airways themselves will not be satisfied with anything less than the considerable power provided by Wright Cyclones.

One way or another, the whole position is extremely unsatisfactory, and the last thing that anybody wants is a vast legal battle which will do neither side any good. And Imperials surely have need of these big landplanes, both for their Empire and their European services. Although little is publicly said about it, they are very short of machines, and have had several mishaps recently which have put even some of the available fleet out of commission.

INDICATOR.

Co-ordinated Air Survey

SINCE the Air Survey Committee in their report, which was published as long ago as 1935, recommended the creation of a central unit for air survey operations in the British Empire, four of the recognised British companies have now been amalgamated under the Aircraft Operating Company, which was originally established in 1923. This amalgamation has been brought about by H. Hemming and Partners, and the new company includes Aerofilms and the Aircraft Operating Company of Africa.

More recently a departmental committee on survey recommended that a unit should be formed in Great Britain, and the A.O.C. have accordingly ordered two D.H. Rapides, which will be available at home during the summer and will supplement the African fleet during the winter. The machines are being fitted with Smiths Mark 1A automatic pilots and with Williamson cameras. At present the African company uses a specially equipped B.A. Gipsy-engined Double Eagle, which has been described in *Flight*, two Dragons and a Puss Moth.

De Havillands in New Zealand

AT the company's nineteenth annual general meeting early in February, the chairman of the De Havilland Company, Mr. A. S. Butler, mentioned that it had been decided to form an associated company in New Zealand. At the end of last month Mr. Hugh Buckingham, who joined D.H.s in 1926, left England to organise this new company, which will have offices and workshops in the neighbourhood of Wellington, North Island. Needless to say, its policy will be to give the necessary attention and service to the New Zealand Government and the airlines, the flying clubs and the private owners.

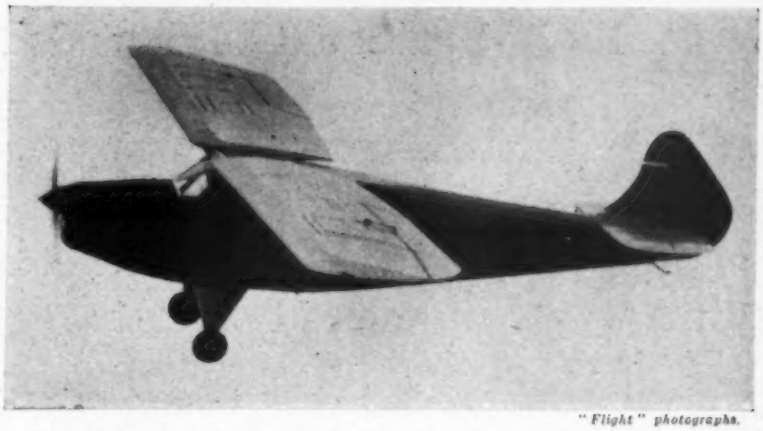
Mr. Buckingham has been on the technical sales side of the company at Stag Lane and Hatfield since 1929, and is well known as a demonstration pilot with a wide experience of civil machines. Before he left England he was married on March 30 to Miss Pamela Willins, the daughter of Mrs. Willins and the late Mr. G. W. S. Willins.

Mr. Hugh Buckingham.

The New Zealand company is actually the sixth overseas concern to be formed by De Havillands. An Australian company was started in 1927, a Canadian company in 1928, an Indian company in 1929, a South African company in 1930 and, lastly, a company in Southern Rhodesia was formed in 1935. All of them, with the various agents and special representatives, act as an extremely useful distribution and servicing organisation for the D.H. products, which now consist not only of aircraft and engines, but of controllable-pitch airscrews.

MORE ABOUT the LUTON MAJOR

A Conventional British Cabin Lightweight with Innocuous Flying Qualities



"*Flight*" photographs.

The Major might be described as a miniature Puss Moth and this flying view shows the similarities as well as the differences—notably a thick wing section.

FOR some time the Americans have rather had a virtual monopoly in the cabin lightweight market and it must be admitted that the present available types, including one which is now being built in this country, have a good many points in their favour. The strut-braced, high-wing cabin layout, whether in tandem or side-by-side-seater form, has certain very definite advantages, and this is the formula chosen by Capt. Latimer-Needham in his new Luton Major.

In this case, however, the wings are arranged to fold, and the roots are attached to the top fuselage members, leaving the roof more or less clear so that the view in upward and rearward directions is reasonably good. For various reasons the pilot and passenger are seated in tandem, but the machine can be flown from either seat and is, in fact, normally flown from that in front.

Dealing briefly with the structural features, the Major is mainly of spruce and plywood, though the engine mounting, undercarriage and main stress-carrying members of the fuselage are, as usual, of steel tubing. The two wing-halves are of conventional design and only one pin must be removed for folding; there are no flaps to lift and no controls to disconnect. When folded the wings are automatically self-locking. The undercarriage is of a straightforward split-axle type.

The cabin is entered from one side only, with the two horizontally hinged doors opening upwards and downwards, and locked at the centre line of the fuselage. If and when summer weather is experienced, the top flap can be removed altogether. There is a small window on the left of the pilot which can be opened when flying in rain or bad visibility. The controls are quite conventional, with, however, an elevator tab.

Until a suitable British engine is available, the machine is being fitted with a Walter Mikron and the prototype actually has a Mikron I with slightly lower power than that of the standard unit.

The maker's object in providing good flying qualities rather than sheer performance has certainly been achieved. With a somewhat limited elevator control, at least, the behaviour at the stall is completely without vice, and, unless the Major is pulled up sharply from a reasonable speed, it is not quite possible to stall it fully. At an indicated airspeed between 40 and 45 m.p.h. there is still some lateral control and there is absolutely no tendency for a wing to drop. The machine simply sits square in the sky and does not even drop its nose to any marked extent.

When flying one-up, at least, the take-off is remarkably good and, remembering the good stalling characteristics, the machine can be made to fly just as soon as the elevators can be used to force it into the air. As might be expected in a high-wing layout with ample cabin window area, the all-round view is good and the only blind spots are those made by one or other wing, particularly during a gliding turn, and by the nose when the machine is in the taildown position. There is plenty of head room and a slightly higher seat would be an advantage in giving better forward visibility.

At the moment the aileron operation is being adjusted to give rather more control. When I flew the machine this control, though pleasantly light, was somewhat inadequate for really safe manœuvring near the ground. Now that the ailerons have been geared up this criticism should no longer apply. They are differentially operated and, consequently, very little rudder correction is necessary even when using full lateral control. With ample rudder area a sideslip can be held quite steeply at a reasonably low speed.

It is difficult to design the seating accommodation in any machine so that the crew can go aboard without gymnastics, and in its prototype form the Major is fitted with jury-rigged seats and the back of that used by the pilot forms a considerable obstruction when entering. In order that it may not be possible for the novice to get into difficulties, the elevator control has been limited to a degree which just permits a full three-point landing. Actually, I found that such a landing was not possible, but, at that time, additional limitations to the elevator control had been accidentally provided by the seat position, and by stretch in the operating cable. In any case, another five degrees of elevator movement has now been arranged. The fact that the forward anchorage of the seat gave way while I was in the air may also have tended to reduce the elevator control and my landings were made with the tail apparently still a foot or thereabouts from the ground. Even so there was no tendency for the tail to lift after the touch-down, and with two people on board all such difficulties should disappear.

So far as can be roughly estimated, the maximum speed of the prototype Major is in the region of 100 m.p.h. and the cruising speed about 90 m.p.h. No accurate timing tests have yet been made and these figures must be taken as being conservative.

In the initial tests, which were carried out by Sqn. Ldr. E. R. Mole, the rate of climb from the ground level was a little over 600 ft./min.—a height of 1,000ft., in fact, was reached in 1 min. 35 sec. at a full throttle climbing speed of 60 m.p.h. Other preliminary figures are—all-up weight, 1,030 lb.; weight empty, 600 lb.; range (9 gall. capacity), 320 miles; and provisional price, £525. The makers are Luton Aircraft, Ltd., Phœnix Works, Gerrard's Cross, Bucks. H. A. T.

This picture — from the "entry" side — gives an idea of the range of view provided for the occupants.

FROM the CLUBS and SCHOOLS

LONDON.
THE flying time for last week was 58 hr. 25 min. Mrs. I. S. Haslewood and Mr. E. B. Moss made their first solo flights, while Mrs. E. M. Reynolds completed the tests for her "A" licence and Mr. I. H. Kestin finished his instructor's course.

DONCASTER.
Forty hours fifty-seven minutes were flown by the Doncaster Aero Club during the week ended March 31.

MARSHALL'S.
The total flying carried out during the week ended March 31 was 88 hr. 30 min. Mr. A. N. Christie made his first solo.

THANET.
The weather has permitted only 1½ flying days, in which 31 hr. were flown. Miss R. Townshend made her first solo flight.

EXETER.
This club has had another rough week with its aircraft grounded for four days by north-easterly gales. Thirty-five hours were flown.

CINQUE PORTS.
The Cinque Ports Flying Club put in 57 hr. flying last week and successful first solos were made by Miss Allaun and Mr. E. Ross, both members of the Civil Air Guard.

EASTBOURNE.
A total of 50 hr. were logged over the week ended March 31. Messrs. Bayliss, Fowler, Viner and O'Neill passed their "A" licence tests and Mr. Bryan Sanderson went solo.

NEWCASTLE-ON-TYNE.
There was no flying for two days last week due to bad weather; the club section flew 24 hr. and the Civil Air Guards put in 56½ hr. Messrs. E. C. Waitt and S. Mallen made their first solos.

PLYMOUTH.
Fifty-one hours were flown during the week ended March 28, despite three days of high wind. Mr. J. Jago made his first solo flight, and Mr. R. G. Cottey passed his "A" licence tests.

PORTSMOUTH.
Mr. P. Lillywhite and Mr. Holdsworth accomplished their first solo flights after only 4 hr. 20 min. dual instruction. Very high winds and bad weather restricted flying considerably last week.

BRISTOL AND WESSEX.
Flying for the month of March amounted to 120 hr., 32 hr. 10 min. of this being flown during the week ended March 31. "A" licences were obtained by Messrs. R. A. Wood and C. F. Stubbs.

STRATHTAY.
Messrs. A. B. Grossett and D. McMartin have qualified for their "A" licences as private club members. For the week ended March 24 a total of 43 hr. flying was recorded, of which the Air Guards contributed 16 hr.

NORFOLK AND NORWICH.
The Civil Air Guard members of the Norfolk and Norwich Aero Club maintained average flying hours last week. One member made a successful first flight and two others have completed their "A" licence tests.

BURY ST. EDMUND'S.
The new clubhouse and bar were officially opened last Saturday in the presence of about 100 members and friends. During the week ended April 2 a total of 40 hr. flying was achieved. Mr. W. W. Hearn completed his "A" licence test.

WESTON.
During the week ended March 28 only three days were suitable for instruction, 28 hr. being flown. Mr. C. D. Salisbury, of the traffic staff, made his first solo flight, and Mr. M. H. Grimmer passed his "A" licence tests.

BARTON (BEDS).
Although bad weather naturally cut down flying times very much eight members obtained their "A" licences. There are some more vacancies in the C.A.G. Miss Jane Grimmer qualified for her "A" licence, and Messrs. G. A. L. Dudeney and G. M. Stephenson went solo.

NORTH BRITISH.
Nearly 30 hr. were flown by the Civil Air Guard members for the week ended March 31. One "A" licence was obtained. Until the new C.A.G. lecture rooms are completed the lectures will be held in the Caledonian Hotel, members being notified of the days of lectures.

GRIMSBY.
Although on ten days rough weather on the coast completely held up flying, 135 hr. were logged by C.A.G. members during March. The following have now completed their "A" licence tests: Messrs. D. R. Cormack, J. W. Middleton, S. M. Beall, R. L. North, J. Davies, L. Berman and J. B. Fenwick. First solo flights were made by Messrs. R. Allen, C. H. Cartwright, N. R. Moody, J. W. Simpson, H. Sproston, G. Ginn, A. W. Hobson and Mrs. C. Ryall.

PENANG.
The flying time for February—113 hr. 5 min.—was slightly down on the previous month's figures. The annual rally and display of the club was held on February 19 with the co-operation of the Royal Air Force, the Straits Settlements Volunteer Air Force and the Malayan Flying Clubs.

BORDER.
Weather records were started during March and it is interesting to note that during that time 12½ days were unfit for flying and only 3½ days fit for beginners and early soloists. During the month 130 hr. were flown, four members making their first solos and three more obtaining their "A" licences.

ROMFORD.
Ninety-one hours were logged at Chigwell Aerodrome during the five days on which flying was possible last week. Messrs. Peat, Brewster, King Polley, Armour, Abthorpe, Webster and Mrs. Mantle went solo and Messrs. Nicholson Armour, Lane, Park and Hustwayte qualified for their "A" licences.

HERTS AND ESSEX.
During the last three weeks of March the flying time amounted to 184 hr. 20 min., making a total of 265 hours for the month. Mr. E. W. Curtis completed his "A" licence tests, and Messrs. W. H. Ansell, R. Drawater, P. C. Geart, F. Harvey, W. E. G. Kirkby, R. W. Liley and G. V. Pryor made their first solos.

BROOKLANDS.
Last Sunday the new Piper Cub Coupe was demonstrated at Brooklands. On April 16 a luncheon flight to the West Malling Flying Club has been planned, while on the following Sunday the first Dawn Patrol of the season will take place. For the week ended April 2 flying took up 85 hr. 50 min. Mr. S. Simpson completed his height test.

IPSWICH.
The Civil Air Guard dance at the Great White Horse was attended by over 230 people and was a great success. It was organised by the Ipswich Civil Air Guard Social Committee, of which Mr. F. Driessen is chairman. Only 1½ days were suitable for flying during the week ended March 28, and 18 hr. were flown. Mr. J. R. E. Stagg passed his "A" licence tests.

SOUTH COAST.
As there is still a long waiting list of applicants for the Civil Air Guard, the club has opened a further section of the C.A.G. at Storrington, with Mr. Symondson as the instructor. The club is at present operating two machines there. A further batch of 20 applicants were medically examined on Thursday for enrolment. Mr. E. M. Edin qualified for his "A" licence, bringing the total of "A" licences obtained during March to nine. During the week ended April 1 44 hr. flying were done.

JOHANNESBURG.
Although flying was curtailed through fog and rain for twenty out of the twenty-four available flying days during February, 556 hr. were flown. Messrs. G. Meyer, P. J. de Villiers and C. le Couteur obtained their "A" licences and Messrs. J. Munro and A. G. Moxham carried out their first solo flights. Messrs. A. R. Knight and E. C. Newborn qualified for their instructor's licences. A new Tiger Moth was put into service on February 1 and has proved a very popular machine with members. Lord Wakefield, of Hythe, assisted in the purchase of this aircraft and the machine has been christened *Lord Wakefield*. The Fox Moth, which has been utilised for ambulance services, is to be fitted with the latest type of aeroplane stretcher.

MADRAS.
"AUTUMNAL February, commencement of India's slowly stocking Fall, passed blue, rainless and leafstrewn, according to its custom, and completed the early withering of the great meadow, which can now know no shower till June. Vast flocks of cheerily chattering mynas, though, escorted by blue jays and black drongoes, apparently find more than usually good foraging in the dun grass and silly falcons, too, always so late to fly aside." Thus, in literary manner, are the words from Madras. "A Supermarine Walrus amphibian from H.M.S. *Norfolk* or *Manchester*, then both in the Madras Harbour, visited the flying club one morning, to the diversion of those assembled, and demonstrated how 750 horses can magic so heavy a craft so quickly off the ground." For the first time in the history of the club, tragedy struck Madras, whereby the Madras Flying Club sustained a great loss in the deaths of Mr. A. S. Ratnam and Lt. Pulkowski in a flying accident to the record-breaking Arado 79. Mr. A. S. Ratnam had been a member of the club for over six years.

The C.A.G. at the Forum

THE aviation lectures which are given at the Forum Club on Wednesdays at 9 p.m. (6, Grosvenor Place, Hyde Park Corner) now open to all women members of the Civil Air Guard. Should the attendance at these lectures prove that they are appreciated, the club hopes that it will be possible to reduce the small charge which is at present made and also to arrange talks covering special subjects.

HERE and THERE

Sailplane Record : Assisting the Navigator : Royal Aeronautical Society News

THE ROYAL TOUR : Two photographs indicative of the interest and enthusiasm shown by the personnel of the Fairey Aviation Company's Heaton Chapel Works when the King made a visit of inspection last week. On the left Mr. C. R. Fairey is seen presenting a member of the works staff to His Majesty.

Sailplane Record Attempt

THE new Slingsby Petrel sailplane with which the instructor of the Furness Gliding Club, Mr. Frank Charles, hopes shortly to make an attempt on the long-distance gliding record, has recently been flown by him and appears to have behaved very well indeed. It is fairly conventional, as modern high-efficiency sailplanes go, but Mr. Charles has had a cockpit cover specially designed for him. The two subsequent Petrels which are now in the stocks will have a more conventional cover similar to that used with the Gull.

During his first serious flight with the machine, Mr. Charles, after reaching a height of 2,800ft. above sea level, lost only 500ft. in a glide of seven miles from the Furness Club site to Goadsbarrow. The pilot did not circle, and the variometer did not show a gain of height at any time during the flight—though presumably the air through which he was passing must have had a slight upward component. Nevertheless, this performance gives a good idea of the Petrel's capabilities.

Faster and Faster

Rapid Navigation Tables, by W. Myerscough and W. Hamilton; 10s. 6d. Pitman and Sons.

TWO members of the staff of the London County Council School of Navigation, Poplar, have collaborated to devise and arrange yet another method of shortening the steps required to obtain an astronomical position line. And very skilfully has the problem been tackled.

The familiar principle of splitting the spherical triangle into two by dropping a perpendicular from the zenith to the opposite, or co-declination, side is employed. The particular merit lies in the arrangement of the figures on each page of the tables, which are designed to give the maximum information with the minimum of cross-reference or employment of auxiliary tables.

Checking against two well-known tables, the arrangement is easier to follow than Gingrich and there is one step less than when using Dreisonstok. A test for accuracy showed that the claim made that "the maximum difference between the altitude, as obtained by the tables, and that calculated by Direct Spherics, is ½′ of arc," is fully justified.

A minor criticism is that the explanation of the examples may be held to err on the side of brevity and conciseness. A user thoroughly conversant with the theory and practice of astronomical navigation, or with spherical trigonometry, will have no difficulty in following the explanation; nowadays, however, there are so many beginners that a fuller explanation, or rearrangement of the steps illustrating the examples, might well be of great assistance to them.

Beginners, as well as experienced navigators, may, however, rest assured that *Rapid Navigation Tables*, with the plotting chart supplied in the pocket, is the best value for money which has yet been seen.

A Famous Fighter for Posterity

A BRISTOL Bulldog, partly stripped to show the all-metal internal structure, is a new addition to Science Museum, South Kensington. It is the gift of the Bristol Aeroplane Company, and it is exhibited alongsisde a 1916 Fokker.

R.Ae.S. News

THE Royal Aeronautical Society lecture fixed for April 20—"Possible Steel Developments for Aircraft," by Dr. T. Swinden—has been unavoidably cancelled.

* * *

After considering the idea for some time, the members of the staff of the De Havilland Company have now decided to form a local branch of the Royal Aeronautical Society at Hatfield. The president will be Capt. Geoffrey de Havilland, the vice-president Mr. L. C. L. Murray, the chairman Mr. C. C. Walker, and the secretary Mr. H. W. L. Calder.

* * *

The first annual dinner and dance of the Portsmouth Branch of the Royal Aeronautical Society was held at the Savoy Café, Southsea, on Friday, March 17.

A company of about eighty sat down to dinner, after which Mr. A. Hessell Tiltman, the president of the branch, proposed the toast of the guests.

Captain J. Laurence Pritchard, secretary of the Royal Aeronautical Society, replied on behalf of the guests, and congratulated the branch on its membership and activities.

Literary Spice

A COMPATRIOT'S touchingly ingenuous description of Yen Hai-wen's last flight (and fight), and of his heroically defiant death in the Japanese lines is among the contents of the first issue of *World Digest*, published by The Amalgamated Press at 6d. Though by no means the first literary "digest" this new monthly makes a unique survey of current international thought. The Editor-in-chief is Sir John Hammerton.

THE ROYAL AERO CLUB YEAR

Matters Discussed at the Annual Meeting : Encouraging the Private Pilot

THE private flying activities of the Royal Aero Club formed the main subject of the remarks made by the chairman, Sir Lindsay Everard, M.P., at the annual general meeting last week. He explained that, in spite of the slight falling off in the amount of air touring owing to the unsettled conditions in Europe, a large number of British pilots had attended the various air rallies and tours. Nearly a hundred machines, for instance, visited Deauville.

During the year recommendations were made to the Air Ministry for increased Customs facilities at certain aerodromes, though efforts to obtain subsidy assistance for the private owner had not so far been successful. The touring committee was now engaged in examining the problems involved in providing radio facilities for the private owner; at the International Telecommunication Conference last year the proposal that a separate wavelength should be reserved for them was approved. A conference would shortly be held at the Air Ministry to discuss the possible shortage in the future of aerodromes for private owners in the London area.

The launching of the C.A.G. scheme had given the General Council of Associated Light Aeroplane Clubs a considerable amount of extra work; at the present time certificates were being issued at four times the rate of previous years. Incidentally, the cost of these certificates had been reduced during the year.

A number of record flights were officially observed by the club during the year, and were subsequently recognised by the F.A.I. The first was that of Flt. Lt. A. E. Clouston and Mr. Victor Ricketts to and from Wellington, New Zealand, in the D.H. Comet which won the London-Melbourne race in 1934, during which they established four new capital-to-capital records between London and Sydney and London and Wellington. Between October 6 and 8, 1938, Capt. D. C. T. Bennett and Mr. I. Harvey flew the upper component of the Short Mayo composite from Dundee to Orange River, thus breaking the long-distance seaplane record by a matter of 783 miles.

On November 5, three Service Wellesleys set out from Ismalia, Egypt, on an attempt on the long-distance record for landplanes. One landed at Keopang, but the other two arrived in formation at Port Darwin on November 7. The non-stop distance of 7,158.5 miles beat the previous record by 853 miles. For this flight Sqn. Ldr. R. Kellett was awarded the Britannia Trophy by the Club. Finally, Sir Lindsay Everard mentioned the flight of Mr. Alex Henshaw in February of this year, when he flew solo from Gravesend to Cape Town and back in a Mew Gull, covering the outward distance of 5,997 miles in 39 hr. 25 min., and the homeward journey in 29 hr. 36 min.

Turning to races, the chairman reviewed the King's Cup race which was won by Mr. Henshaw in his Mew Gull at an average speed of 236.25 m.p.h. The London-Isle of Man race was won by Mr. S. T. Lowe (Comper Swift); the London-Cardiff race was won by Mr. G. de Havilland (T.K.2); and the Folkestone Aero Trophy was won by Mr. H. Buckingham (Hornet Moth).

Incidentally, the nine members of the long-distance flight, with Capt. Bennett and Messrs. Harvey and Henshaw, were all present at the general meeting, and the Duke of Atholl, the President, handed the F.A.I. diploma to each of them.

Sir Lindsay reminded his listeners that all the British Gliding Association's secretarial work was carried out by the Club. During 1938 twenty pilots obtained their "Silver C" awards, bringing the total who possessed this badge to fifty. This higher award was only instituted during last year, but Mr. P. A. Wills obtained one, the "Gold C." To obtain it a pilot had to possess a "Silver C." and, in addition, carry out a distance flight of over 186 miles and a height test of more than 9,843ft. The following new national records for height, duration, and distance were established during the year:—Height (single-seaters), 10,080ft. on June 5 by P. A. Wills; distance (single-seaters), 209 miles on April 30 by P. A. Wills; duration (single-seaters), 15 hr. 47 min. on August 18 by Sub. Lt. A. N. Young, R.N.; and duration (multi-seaters), 22 hr. 13 min. 35 sec. on July 9-10 by Flt. Lt. W. B. Murray and J. S. Sproule.

SHOWING APPRECIATION

The R.Ae.C. Dinner to Sir Lindsay Everard

COLLECTED in one room were more, probably, of the important personalities in aviation than had been seen together for many years when the Royal Aero Club gave a dinner last week to Sir Lindsay Everard, M.P., to express its appreciation of his services as chairman of the Club for the last three years, and to mark the honour of a Knighthood recently conferred upon him. To mention only a few names, the list of guests and members present included Sir Kingsley Wood, Air Chief Marshal Sir Cyril Newall, Lt. Col. Sir Francis Shelmerdine and Lt. Col. J. T. C. Moore-Brabazon.

Mr. F. Handley Page was in the chair, and he opened his remarks in proposing the toast to Sir Lindsay by alluding to the way in which so many of the important people in aviation had managed to find the time to come to an informal dinner of this kind. Thereafter he stressed the importance of the work which Sir Lindsay had done during three years as chairman. In particular he stressed his particular services to private flying, on which Mr. Handley Page thought, the real future of flying would ultimately rest.

In support, Sir Kingsley Wood said how much the Air Ministry owed to Sir Lindsay, who had, in the House, always been on the side of those who wanted the country to look to its defences. He spoke of the importance of the Civil Air Guard scheme—for which Sir Lindsay is a Commissioner—in providing propaganda for aviation as a whole, and hoped that Sir Lindsay's services to aviation would be available for many years to come. During the dinner he sat next to Mr. Handley Page and he had been told before he arrived that he should be careful in his conversation ; however, he had had a quiet talk with him on the matter of manufacturing profits, and this question had now been amicably settled! In conclusion, Sir Kingsley called on the Chief of Air Staff to make his contribution to the evening's speech-making.

Air Chief Marshal Sir Cyril Newall complained that he had not, in spite of what Sir Kingsley had said, received any warning of this ordeal, and mentioned in the course of a few useful and pointed remarks that Sir Lindsay had recently been appointed Honorary Air Commodore of No. 605 (County of Warwick) Auxiliary Air Force Squadron.

In his reply, Sir Lindsay Everard, after an almost inevitable gibe at the chairman's expense on the subject of safety (and slots in particular), said that at this dinner the Secretary of State for Air and the Chief of Air Staff were probably together for the first time. He suggested that they should both be made honorary members of the Club. He mentioned particularly the very good and vital work which is done by the members of the various sub-committees of the Club, and had a word to say for the efforts of the Secretary, Cdr. H. E. Perrin, who was "capable of dealing with anybody at any time." As an instance he told one or two stories of the days at Mildenhall before the start of the England-Australia race three years ago. He asked that Sir Kingsley Wood should not hesitate to tell the Club how it could assist the Air Ministry in any matter relating to aviation.

After Lord Gorell had briefly proposed the toast of the evening's chairman, Mr. Handley Page stressed the fact that everybody in the room was intensely interested in aviation which, he hoped, would enjoy peaceful rather than warlike development.

Some C.A.G. Figures

WHEN presiding at the annual meeting of the County Flying Club, the president, Sir Lindsay Everard, gave some interesting figures for the number of C.A.G. pupils which have been trained at the various centres. Apparently the Southend Club tops the list with 46 members trained up to the end of February.

London Air Park Flying Club have trained 41, the Redhill Club 37, the Bournemouth Club 36, the Portsmouth Club 29, the Hampshire Club 24, the Cinque Ports Club 23 and the County Club 22.

Sir Lindsay also mentioned the efforts which were being made to release the younger applicants from their present national exemption. In Birmingham, for instance, it was found that three-quarters of the Civil Air Guard were in this anomalous position.

SERVICE AVIATION

Royal Air Force and Official Announcements : Fleet Air Arm News : Military Aviation Abroad

His Majesty's Message on the Coming of Age of the Royal Air Force

ON the occasion of the 21st Anniversary of the Royal Air Force, I send my congratulations and good wishes to all ranks of the Service and to all employed in the Air Ministry.

I have known the Royal Air Force from its earliest days, and I am proud to think that its spirit remains unchanged—a spirit that has enabled it to surmount so many difficulties and to rise, true to its motto, to even greater heights of achievement.

(*Signed*) GEORGE R.I.

R.A.F. Official photograph, Crown copyright

FAST FORMATION : The first picture released for publication of Vickers Supermarine Spitfires in formation. This formidable fighter, with Rolls-Royce Merlin II engine, is capable of 362 m.p.h. Take-off, climb and cruising speed will be improved upon when three-bladed v.p. airscrews are fitted.

The Coming of Age

IN addition to the message from His Majesty the King, reproduced above, the following congratulatory messages on the coming of age of the Royal Air Force have been sent by Sir Kingsley Wood, M.P., Secretary of State for Air; Marshal of the Royal Air Force the Viscount Trenchard; and Air Chief Marshal Sir Cyril Newall, Chief of the Air Staff :—

Sir Kingsley Wood : "I am proud to have the privilege as the Secretary of State for Air of sending a message of congratulation and good wishes to the Royal Air Force on the 21st anniversary of its creation as a separate Service.

"Since I became Secretary of State I have visited a large number of units in the Service and have seen much of the daily life and work of the Royal Air Force. I have been deeply impressed by the high standard of zeal and efficiency everywhere displayed; and I feel it to be a very great honour to be associated with a force which, in the comparatively brief period of its existence, has won for itself such a high place in the esteem of the nation and in the respect of the whole world.—(Signed) KINGSLEY WOOD."

Marshal of the Royal Air Force the Viscount Trenchard : "I would like, if I may, to send on this day that means so much to the Royal Air Force my congratulations to all those who are now in it on their 'Coming of Age.'

'As I was present as its first Chief of the Air Staff at its birth on the 1st April, 1918, I well know with what anxiety we all watched those early days. I think that history will record that no other Service has within twenty-one years made such remarkable progress. The Royal Air Force has had to face tremendous difficulties which it has successfully lived through, and I feel certain that the spirit that was created in the Great War of 1914-1918 is not only alive to-day, but is the source of its strength. The whole world is now anxiously watching this Service, and I hope that by its strength it will help to prevent that appalling catastrophe, war. May its life in the future be more peaceful than in the past.—(Signed) TRENCHARD."

Air Chief Marshal Sir Cyril Newall : "Twenty-one years ago the Royal Air Force was created, in times of stress and danger, a new Service to fulfil a great duty. To-day we come of age, proud of the tradition we have inherited and confident in our ability to maintain it.

"The task which in these critical times we may have to perform is greater than it has ever been before; but the success with which the efforts of all have been rewarded in the vast expansion we have undertaken is evidence of an untiring efficiency and an unshakeable determination.

"I am convinced that if the Royal Air Force should be called upon once more to defend our Country and Empire it will maintain that reputation for high hearted courage and devotion to duty which it so fully earned in the past.

"The work immediately before us is that of bringing the peace-time efficiency of the Royal Air Force up to the highest possible level; and to this each of us is in his own way contributing whether in the air or on the ground.

"All ranks of the Royal Air Force, regular, auxiliary, and reserve, are, I know, resolved that nothing that they can do to promote the efficiency of the great Service to which they have the honour to belong shall be left undone.—(Signed) C. L. N. NEWALL, Chief of the Air Staff.

R.A.F. Mission for New Zealand

THE R.A.F. Mission which is at present in Australia to study production possibilities, will next visit New Zealand, at the invitation of the Dominion Government, to make a similar survey.

As recorded elsewhere in this issue Mr. Hugh Buckingham, of the De Havilland Company, has left for New Zealand to take charge of a D.H. factory to be established, as likely as not, at Rongotai Aerodrome, Wellington.

Thirty Vickers Wellingtons are soon to be flown out for the re-equipment of certain bomber units of the R.N.Z.A.F

Service Aviation

ROYAL VISIT: His Majesty the King during his visit last Friday to the Newton Heath (Manchester) works of A. V. Roe and Co., Ltd., where he saw Ansons, Blenheims and other types under construction. He is seen above with (right) Mr. F. S. Spriggs (managing director, Hawker-Siddeleys) and Mr. R. H. Dobson (works manager, A. V. Roe and Co.). Just behind the King is Sir Charles Bruce-Gardner, chairman of the S.B.A.C. Previously His Majesty had inspected the A. V. Roe components plant at Ivy Mill, Failsworth.

"Flight" photograph.

For Distinguished Service

THE King has been graciously pleased to approve of the undermentioned rewards for gallant and distinguished services rendered in Palestine and the Aden protectorate respectively:—

PALESTINE

Distinguished Service Order.—F/O. Robert Cassells Waddell, D.F.C. (since deceased).

Distinguished Flying Medal.—A./C.1 Richard Jennings (since deceased).

ADEN PROTECTORATE

Bar to the Distinguished Service Order.—Wing Cdr. John Francis Tufnell Barrett, D.S.O., A.F.C.

Distinguished Flying Cross.—F/O. Richard Irvin Knight Edwards.

Distinguished Flying Medal.—Sgt. John Harold Elshaw.

The names of the undermentioned have been brought to notice by the Air Officer formerly Commanding British Forces in Aden, for distinguished services rendered in connection with the operations in the Aden Protectorate on April 29 and 30, 1938, and from July 6 to September 4, 1938:—Flt. Lt. (now Sqn. Ldr.) Alfred Hardwicke Marsack, M.B.E.; Flt. Lt. (now Sqn. Ldr.) Arthur Roger Glencross; W/O. Edward Harry White; Sgt. Hubert Davenport Buswell; Cpl. William Derrick Bruce; Cpl. William Edmund Chapman; A/C.1 Robert Stanley Pearce.

Municipal Affiliations of Squadrons

THE Secretary of State for Air has approved a scheme for the affiliation of R.A.F. Squadrons to the principal cities and towns. It is hoped that the public may thus become better acquainted with R.A.F. units, the aircraft with which they are equipped and the personnel who man them.

Each squadron will pay an annual ceremonial visit to the town with which it is affiliated and will give a demonstration of formation flying. On these occasions the public will also be given an opportunity to view the aircraft on the ground and to talk with the crews. If Service commitments permit, squadrons may participate in civic events. Most of the municipalities which have already made affiliations have civil aerodromes close by. Flying-boat squadrons will moor near the town of their adoption.

In addition to 53 units whose names are announced a number of others have intimated that they wish to make affiliations when aerodromes are available in their vicinity. Further affiliations will, therefore, be arranged from time to time.

Canada's "Home-grown" Fighter

THE new Canadian single-seater fighter to which reference was made in *Flight* last week is a product of the Canadian Car and Foundry Company, whose works are at Fort William, Ontario, and it has been designed by Michael Gregor. The machine is now undergoing tests by the Department of National Defence at Ottawa. It is reported that it will climb to 10,000ft. in 3 min.; that its top speed is 300 m.p.h.; that it can land at 57 m.p.h.; that the gross weight is 4,100 lb.; and that the ceiling is 32,000ft. A statement that it has an operating range at 300 m.p.h. of 1,000 miles should be treated with reserve.

The Gregor is designed to carry two 116 lb. bombs, two 0.5 synchronised machine guns and 1,000 rounds of ammunition.

The Hurricane Abroad

SMALL batches of Hawker Hurricane eight-gun single-seater fighters have lately been delivered to the Air Forces of South Africa and Canada. On arrival in Durban a number of the S.A.A.F. Hurricanes were flown to Johannesburg in record time and have since proved extremely popular among all concerned with their operation and maintenance.

The batch supplied to Canada was unshipped at Vancouver, where the machines were assembled before being flown by pilots of the Royal Canadian Air Force (whose present standard single-seater fighter is the Siskin!) to Sea Island aerodrome. It is reported that one machine, after being tested, was handed over to a Sergeant Pilot. On his first take-off the Hurricane was seen to swing away from the runway and at a speed of about 60 m.p.h. struck the wing of a commercial machine, pitching forward and catching fire. The pilot escaped without serious injury.

A rational explanation seems to be that the pilot was not used to the take-off characteristics of a modern aircraft with 1,000 h.p. in the nose. The tendency of such machines to swing, due to torque, is noticeable in types with considerably less power, but may be overcome quite easily by applying heavy opposite rudder during the early stages of the take-off run.

In view of the popularity of the Hurricane in the R.A.F. it would be ludicrous to suppose that the take-off of this outstandingly successful machine is any more dangerous than that of any other aircraft in the same category. Only when co-axial airscrews, rotating in opposite directions, come into vogue or when we have twin-engined machines with left- and right-hand airscrews, shall we have complete immunity from swing.

R.A.F.V.R. Manchester Centre

MEMBERS of the R.A.F.V.R., Manchester District, gave a dance at the Midland Hotel on Friday, March 24. The evening was very successful, in spite of the fact that certain official guests, including the Lord Mayor, were unable to be present owing to other engagements.

Flying Accidents

THE Air Ministry regrets to announce the following accidents:—Flt. Lt. Harold Bertie Robertson and Sgt. Edward George Dyas lost their lives as the result of a collision in the air which occurred at North Benfleet on March 25 between two aircraft of No. 34 Elementary and Reserve Flying Training School, Southend. Sgt. Dyas was the pilot and Flt. Lt. Robertson the occupant of one aircraft, and Sgt. L. T. Wilton-Jones the pilot and sole occupant of the other aircraft. Sgt. Wilton-Jones was not injured.

With reference to the accident at Litcham, near Marham, on March 23, to an aircraft of No. 207 (Bomber) Squadron, Cottesmore, Rutland, the Air Ministry regrets to announce that P/O. Guy Cecil Shepherd (pilot), A./Sgt. Francis Charles Talbot Norman, and A/C.1 John Thomas Samuel Randle, lost their lives on that date.

P/O. Richard Albert Cyril Kent (flying solo) lost his life in an accident which occurred at Corby on March 29, 1939, to an aircraft of No. 46 Squadron, Digby, Lincolnshire.

Royal Air Force Gazette

Air Ministry, March 28

Royal Air Force

General Duties Branch

The following are granted short-service commissions as Pilot Officers for five years on the active list (March 15):—G. W. F. Carey, B. I. Clifford-Jones, R. W. Gair, C. McK. Hill, H. J. Keller, H. W. Lamond, L. G. W. Lilly, A. J. Macdonald, J. D. Murphy, I. C. Patterson, P. W. Rabone, D. A. Rankin, W. S. Rea, K. R. Sutton, P. N. Trolove, C. N. Whittington, G. J. D. Yorke.

G. B. Treasure (from Reserve) is granted a short-service commission as Pilot Officer on probation (March 8).

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—R. N. J. White (December 16, 1938); G. L. Cruickshanks (January 12); C. W. K. Nicholls (February 24); H. M. Pinfold, R. G. Forshaw (Acting Flight Lieutenant), K. C. Gill (Acting Flight Lieutenant), D. C. R. Macdonald (March 14).

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—C. G. H. Crusoe (January 8); H. F. Plank (January 10); D. P. W. R. Robinson (January 30); D. F. H. Brown (February 18); J. R. S. Romanes (February 24); F. Hume (February 28); N. M. Thomas, D. S. Thom (March 4); F. C. Griffiths (March 8); E. H. Thompson, P. S. Weaver (March 10); J. N. Cuverwell (March 13); D. L. R. Halliday (March 17); P. Burnett (March 23); W. B. Baxter, J. A. Ingram (March 24); J. F. McKinlay, G. F. Graham (March 26).

Wing Cdr. R. P. M. Whitham, O.B.E., M.C., is granted the acting rank of Group Captain (paid) on appointment as Deputy Director of War Organisation, Air Ministry (December 24, 1938). (Substituted for notification in *Gazette* of December 27, 1938); Wing Cdr. L. N. Hollinghurst, O.B.E., D.F.C., is granted the acting rank of Group Captain (paid) on appointment as Deputy Director of Peace Organisation, Air Ministry (January 1). (Substituted for notification in *Gazette* of January 10.)

The following Flying Officers are granted the acting rank of Flight Lieutenant on the dates stated:—D. H. C. Hull (November 10, 1938); H. D. Jones (November 16, 1938); G. F. Hall (December 6, 1938); W. A. L. Locker (December 12, 1938); R. B. Cox (December 14, 1938); V. A. Pope (January 1); R. W. Hase (March 1); H. R. Larkin, A. J. Trumble, K. Slater, G. M. Wyatt, J. D. Harris, D. J. McGlinn, C. B. Hull, R. D. C. Gibson, P. R. Walker, C. L. C. Roberts, A. A. Dilnot, W. C. Williams, P. E. G. G. Connolly, L. E. Abel, H. F. Burton, I. S. Soden, J. A. Roncoroni, A. R. Putt, E. J. Little, K. H. Savage, A. G. Malan, W. P. F. Treacy, D. T. Collins, M. N. McF. Kennedy, A. N. Jones, G. C. O. Key, C. R. Mace, D. R. Miller, P. M. Brothers, J. Gillan, L. Gregory, H. Stringer, J. Avent, A. E. Thompson (March 2); F. R. McAlister (March 6); M. V. Blake (March 9).

The following Pilot Officers are granted the acting rank of Flight Lieutenant on the dates stated:—C. Scragg (Acting Flying Officer), F. Austin (Acting Flying Officer), A. W. H. Reader (Acting Flight Officer) (February 11); P. S. Q. Andersen (February 20); A. J. H. Finch (February 21); P. H. Lee (March 6); J. E. Boulton (March 9).

P/O. A. W. H. Reader is granted the acting rank of Flying Officer (January 25); F/O. R. W. Hase relinquishes the acting rank of Flight Lieutenant (August 26, 1938); F/O. H. D. Jones relinquishes the acting rank of Flight Lieutenant (February 27); P/O. F. Austin relinquishes the acting rank of Flight Lieutenant (March 9); Group Capt. J. B. Graham, M.C., A.F.C., is placed on the half-pay list, Scale B, from November 8, 1938, to March 31 inclusive; Sqn. Ldr. L. E. Jarman is placed on the half-pay list, Scale B, from February 24 to March 31 inclusive; Flt. Lt. A. C. P. Carver is placed on the half-pay list, Scale B, from February 27 to March 6 inclusive; Lt.-Cdr. J. de F. Jago, R.N., is reattached to the Royal Air Force as a Flight Lieutenant, with effect from March 15, and with seniority of July 1, 1935; Lieutenant D. D. O'Brien, R.N. (since deceased) is reattached to the Royal Air Force as Flight Lieutenant with effect from March 15 and with seniority of January 1, 1937; Acting Pilot Officer on probation P. R. M. Groom is transferred to the Equipment Branch on probation in the rank of Pilot Officer (January 23) (substituted for notification in *Gazette* of March 14).

The following officers are transferred to the Reserve, Class A (March 24):—Flt. Lts. J. S. Bartlett, G. P. Seymour-Price, F. C. Scott; F/O. W. E. Legard.

Equipment Branch

F/O. L. C. Dennis is granted the acting rank of Flight Lieutenant (February 1).

Medical Branch

The following Flying Officers are promoted to the rank of Flight Lieutenant (January 3):—C. N. Young, M.B., Ch.B., J. C. Groves, M.B., B.Ch.

Chaplains Branch

The Reverend G. E. H. Richards is granted a short-service commission with the relative rank of Squadron Leader (March 16); the Reverend C. E. Warrington, L.Th., resigns his short-service commission (March 18).

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

J. A. Tinne is granted a commission in Class A as Flying Officer, with effect from March 21, and with seniority of December 27, 1934.

The following are granted commissions in Class CC in the ranks stated on the dates stated:—*Flight Lieutenants.*—Major F. E. M. Clarke (Sp. U.L., I.A.) (January 2); Major F. H. Worlledge (I.A. Ret.) (January 21); Major D. G. Romanis, M.C. (R.A.R.O.) (February 20); Major G. L. Shipton (Sp. U.L., I.A.) (February 27). F/O. W. Batey (January 9).

Maj. A. C. Horsbrugh is granted an honorary commission in Class C as a Flying Officer (Honorary Squadron Leader) (December 28, 1938); Flt. Lt. G. A. V. Tyson is transferred from Class A to Class C (March 13); Flt. Lt. P. E. Hudson is transferred from Class B to Class C (March 18); F/O. (Honorary Flt. Lt.) A. M. Mitchell resigns his commission and is permitted to retain the rank of Flight Lieutenant (December 23, 1938); Flt. Lt. N. Daunt relinquishes his commission on completion of service (March 15); F/O. R. G. Allen relinquishes his commission on appointment to a commission in the Royal Air Force Volunteer Reserve (February 14); P/O. G. B. Treasure relinquishes his commission on appointment to a short-service commission in the Royal Air Force (March 8).

Royal Air Force Volunteer Reserve

General Duties Branch

R. G. Allen is granted a commission as Flying Officer, with effect from February 14 and with seniority of September 19, 1935.

Administrative and Special Duties Branch

The following are granted commissions as Pilot Officers on probation (March 21):—G. S. Airey, L. W. Allen, M.C., E. S. I. Cole, M.C., H. R. de Wilde, D.F.C., H. O. Edmonds, T. Elder-Hearn, P. Fish, W. Hamley, K. G. P. Hendrie, H. E. Hounsell, R. S. S. Ingram, A. C. T. Isaac, B. W. Jeffries, S. Jolley, M.C., S. W. Lewis, E. A. Marriott, G. Milner, E. G. Oakley-Beuttler, O.B.E., G. E. T. O'Kill, O. W. Pellatt, A. H. C. Randall, D. S. Rapson, W. A. Simmons, J. V. Wilson.

Equipment Branch

Sqn. Ldr. H. C. Fuller is granted a commission as Flight Lieutenant (Honorary Squadron Leader) with effect from September 27, 1938, and relinquishes his commission with effect from October 12, 1938.

The following Acting Pilot Officers on probation are confirmed in their appointments on the dates stated:—

J. P. Bennett, L. N. Bennett, R. H. Berry, W. E. Gower, M. K. Tapp (November 30, 1938); E. R. J. Smith, C. D. Biggs, G. E. Runeckles, L. M. Kitching, T. G. P. Hidson, R. A. J. Horne, R. S. W. Macfarlan, L. D. Neeves, H. B. Whissell, S. W. Yardley (December 7, 1938); D. W. Chapman, D. A. Doughty, E. A. Jackson, T. G. Ratcliff, A. L. Smith, G. P. Stevens (December 14, 1938); G. M. Eiloart, D.F.C., G. N. Ricks, W. E. G. Vaughan, A. L. Allen, M. Bowles, P. F. Humphreys, C. D. King, J. Moorhouse, F. A. H. Smail, H. S. Wolff (December 21, 1938); M. V. J. de Fauque de Jonquières, J. S. Thomas, P. H. Riggs, K. V. McKenzie, W. F. Blackman, A. D. Hadler, H. G. Hanks, H. W. Heycock, E. D. B. Payne, W. Royle, T. H. Snelling (December 28, 1938); O. M. Berkeley, J. G. Davis, R. E. W. Little, C. Cooke, R. G. Kingston, E. D. W. Mercer, F. L. Mills, A. E. Rich, E. A. Sadler, A. H. K. Stevens, E. H. Proctor (January 5).

J. D. Neil, C. R. C. Marlow, P. H. Youngman, C. W. Harman, R. H. Gollan, H. A. Jordan, B. A. Taylor (January 12); A. Beare, D. R. S. P. Quin, A. C. Ridge, E. B. Wilson, D. F. Hackett, F. C. Emerson, F. H. Farthing, A. L. Godden, A. Jones, J. C. Jordan, H. D. Paterson (January 19); J. F. H. Adams, J. W. J. Bates, M. J. P. F. H. D'A. de Froberville, C. E. Polack, J. Smith, R. E. N. Tasker, E. Taylor, E. J. Vince, F. D. Wheeler (January 26).

Medical Branch

The following are granted commissions as Flying Officers (March 28):—R. F. Dawson, M.B., Ch.B., J. Park, M.B., Ch.B., W. M. D. Robertson, M.B., Ch.B.

Auxiliary Air Force

General Duties Branch

Flt. Lt. (Honorary Sqn. Ldr.) H. C. Fuller relinquishes his commission with effect from September 27, 1938, on appointment to a commission in the Royal Air Force Volunteer Reserve and is reappointed to the Auxiliary Air Force with effect from October 12, 1938.

No. 500 (COUNTY OF KENT) SQUADRON.—A. Swainston is granted a commission as Acting Pilot Officer (January 31).

No. 605 (COUNTY OF WARWICK) SQUADRON.—F/O. R. G. Grant-Ferris, M.P., is promoted to the rank of Flight Lieutenant (January 11); Flt. Lt. W. M. Churchill relinquishes his commission on completion of service (January 11).

No. 910 (COUNTY OF ESSEX) (BALLOON) SQUADRON.—Lt.-Col. (Bt. Col.) P. H. Tanner, M.B.E., M.C., T.D. (T.A.R.O.), is granted a commission as Flight Lieutenant (July 5, 1938). (Substituted for notification in *Gazette* of October 4, 1938.)

No. 615 (COUNTY OF SURREY) SQUADRON.—The following are granted commissions as Acting Pilot Officers on the dates stated:—P. G. M. Hancock (March 3); D. J. Looker (March 4).

No. 919 (WEST LANCASHIRE) (BALLOON) SQUADRON.—L. B. Ridley is granted a commission as Acting Pilot Officer (January 25).

No. 935 (COUNTY OF GLAMORGAN) (BALLOON) SQUADRON.—A. G. Matthew is granted a commission as Acting Pilot Officer (February 2).

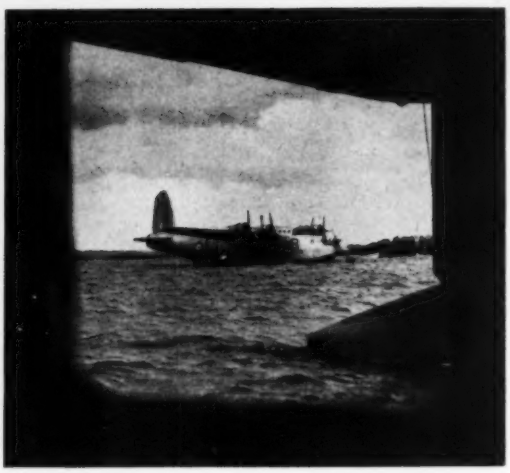
Auxiliary Air Force Reserve of Officers

General Duties Branch

W. M. Churchill is granted a commission as Flight Lieutenant in Class A (January 11).

THIS DESIRABLE RESIDENCE . . .

The Short Sunderland (four Bristol Pegasus XXII) offers—on two floors—plenty of home comforts for its crew. These interior views were taken by *Flight's* chief photographer during the escort flight for the French President's visit. They show a control cabin view (the cylinders in the rack are Very cartridges), a member of the crew handling a drogue from the galley hatch (note the homely kettle and teapot), the navigator at work, and a glimpse through a window.



THE AERONAUTICAL BOOKSHELF

Anthology

"Icarus, an Anthology of the Poetry of Flight"; compiled by R. de la Bère and three Flight Cadets of the R.A.F. College, Cranwell; 7s. 6d. Macmillan and Co.

SOME time ago Professor de la Bère produced *The Unending Conquest*, an anthology of prose passages about flying, which was a very attractive little volume. He has now followed it up with an equally attractive selection of verses on the same subject. He has not confined his collection to modern verse, for he starts with Homer and Aristophanes. His ninety-odd poets treat of flight of all kinds, of birds and butterflies and witches as well as of aeroplanes, and the illustrations likewise deal with both. We especially like a photograph of a flight of Ibises by Capt. C. W. R. Knight.

All the Licences

Civil Aviation as a Career, by T. Stanhope Sprigg; 5s. George Newnes, Ltd.

REMEMBERING the number of enquiries which we ourselves receive on matters relating to licences of different kinds and to the qualifications required, Mr. Stanhope Sprigg's book should be most useful as a reference volume. Its title somewhat belies the nature of the contents, since the casual reader might at first imagine that it is an explanation of the ways and means by which a civil pilot may earn an honest living.

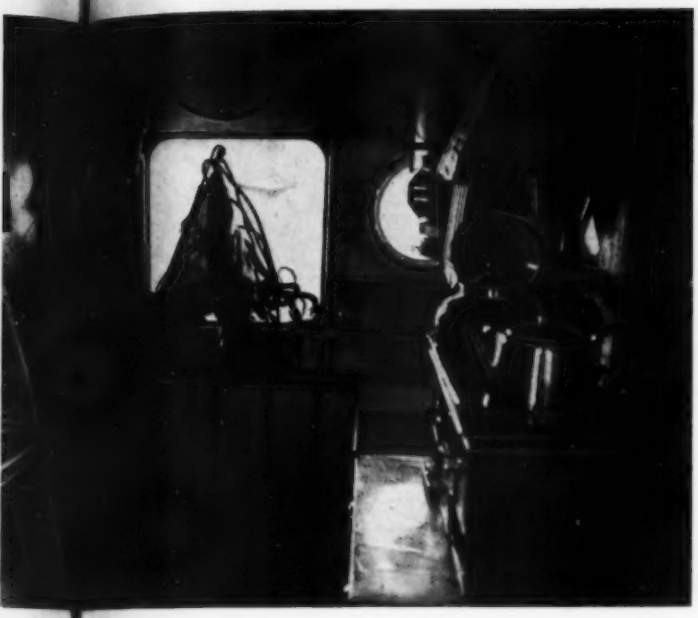
In fact, *Civil Aviation as a Career* is simply and solely a detailed description of all the licences and certificates—twenty-one of them—which can be obtained by the pilot, the engineer, or the radio operator. Starting, of course, with the "A" pilot's licence, Mr. Sprigg deals with every one, including those for balloon and airship pilotage, exhibition parachuting and gliding. The only chapter which does not appear to be quite up to date is that dealing with instructors' certificates; no mention is made of the new assistant instructors' category, in which only a hundred hours' solo flying is demanded as a preliminary qualification.

At the end, thirty-odd pages are given up to appendices covering the syllabuses of the different examinations and giving a most useful list of the books recommended for study in connection with the work involved on the different licences. Finally, there is also a list of the principal flying, ground engineering and wireless operation training centres, as well as a list of the firms in the British aircraft industry where apprenticeship schemes are in operation.

The Complete Meteorologist

Aeronautical Meteorology, by G. F. Taylor; 18s. Published by Sir Isaac Pitman and Sons.

IT is obviously impossible to produce a single book on a subject such as meteorology to cover the entire field, and to be as suited to the needs of the beginner as to those of the fairly experienced professional pilot or control officer. *Aeronautical Meteorology* deals with the whole subject and is intended to be both a practical guide and a text book for the student, who



is, however, expected to have a fairly good basic knowledge of the subject. The absolute beginner is virtually dismissed in a fourteen-page opening chapter.

On the other hand, the writer has endeavoured, as far as possible, to reduce the unnecessary use of mathematics and the only really advanced chapters are those concerned with thermo-dynamics and circulation. Essentially the book is a practical one and, apart from thorough sections explaining weather-chart layout methods, analysis and forecasting, there are chapters on the methods used by the American airline companies' meteorological departments and on what is known as climatology—in which such matters as airway and airport location are discussed. Probably the most interesting chapters deal with "air masses" over North America, Europe and Asia, and with modern methods of forecasting conditions over really large areas.

Altogether this book is probably the most complete one to be produced on the subject of meteorology from the flying point of view, though the author is an American—actually the chief meteorologist of Western Air Express—and his theories may not necessarily be those held by experts on this side of the Atlantic. It is worth mentioning here that in the United States each of the major airline companies has its own meteorological department, working in collaboration with the Government Weather Bureau. The complete nature of *Aeronautical Meteorology* may be gathered from the fact that references to books and papers are given at the end of each chapter, while, in order to make the book self-sufficient, all the essential tables are provided in an appendix.

In the Grand Manner

"A Flying Start," by Rene MacColl; 8s. 6d. Jonathan Cape, London.

ALMOST entertaining story by a Fleet Street man who, soon after a not-too-auspicious incursion into a business life, found himself appointed as private secretary to that almost legendary flying millionaire, the late Van-Lear Black of Baltimore.

Mr. MacColl describes their various long-distance flights together first in machines chartered from K.L.M., and then in Black's own Fokker, to fly which he engaged the two K.L.M. pilots who had flown him on his previous trips, Geysendorffer and Scholte.

The author is entertaining all the time, whether describing his own undergraduate days at Oxford, a Rugby match in Belgium "civil disobedience" riots in India or Van-Lear Black's prodigious tipping—once, after a casual dinner in a Copenhagen restaurant, he handed a £10 note to each of five waiters.

As an example of Mr. MacColl's style, here is the climax of a return flight from South Africa in the Fokker:—

"*The Maryland Free State* was flying about a quarter of a mile out to sea at 150ft. altitude.

"As the sunlit and sleepy coast slowly unrolled its picturesque length the symptoms from the faulty engine grew alarming. Blue smoke came belching out, and the mechanic, who had been sitting staring at it, gave a sudden gesture of dismay.

"While we gazed in silent unison the engine fell to pieces before our eyes. Piston rings, bolts, nuts and other objects dropped away in a continual stream. Two of the cylinders began to vibrate violently. It seemed as though at any moment they would join the rest of the debris and seek the Mediterranean.

"One of the three engines that had so unfalteringly borne us to Cape Town and almost back again, whose steady efficiency we had come to take for granted, was disintegrating in the air like a lump of sugar in boiling tea."

Fearing that the erupting engine might damage the structure, the pilots decided on a forced landing on the beach:—

"The stream slid by just below. The beach, all loose sand and large rocks, followed. Were we going to run into the fence? There was a jar as the wheels touched ground, followed by a succession of lesser shocks as the stones and rocks were negotiated. The 'plane slewed violently to one side in the soft sand—then recovered. The fence and houses rushed to meet us, slowed, stopped. 'And dat's dat,' said Geysendorffer, opening the cockpit door. . ."

Seeing Africa—and Europe

Vingt Mille Lieues dans les Airs, by Baron de Foucaucourt; 32 francs. Published by Payot, 106, Boulevard Saint-Germain, Paris.

DESCRIBING a long-period tour of Europe and, later, of Africa, including both the west and east coast routes, it is unfortunate for prospective English readers who are interested in this type of book that it is published in French. Baron de Foucaucourt is the owner-pilot of a Percival Vega Gull, which he named *l'Inch'Allah*, and during last year he took this machine from Paris up to the Baltic States, down again through Central Europe, across the Sahara, down part of the east coast of Africa and north again round the whole of the west coast.

Only those who are intimately conversant with the French language would be able to judge whether the story is of literary merit, but the author certainly seems to have had any number of amusing and interesting experiences, and he writes with *élan*. It is illustrated by quite a large number of photographs, mainly of subjects of terrestrial interest. In an introduction, General Pierre Weiss says some very nice things about both the book and the author.

Stopping the Raider

"Views on Air Defence," by Lt.-Gen. N. N. Golovine in collaboration with a technical expert; 5s. Gale and Polden, Ltd.

SPECIALISATION of aircraft, advocated in 1936 in the authors' first book, *Air Strategy*, is still one of the basic themes in this provocative work. The fact that the volume embodies a series of articles published in the *Royal Air Force Quarterly* during the past two years detracts little from the interest of what is stated to be "in a way . . . a record of the evolution of a defensive theory" which the authors believe must come into being in one form or another.

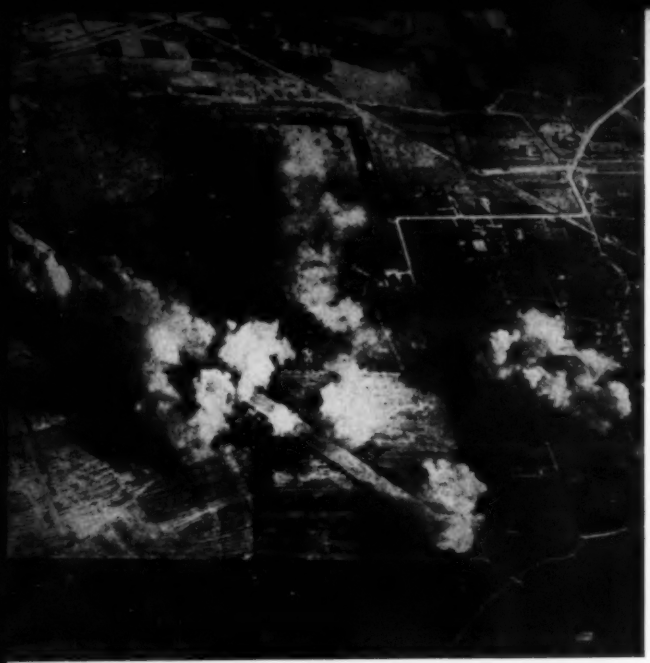
In their foreword the authors opine that no "retaliatory" methods or A.R.P. developments can provide the necessary measure of security for the citizen who lives in an overcrowded city. Attackers, they claim, must be met in the air and further raids prevented by inflicting severe losses on hostile units and by breaking the morale of enemy crews.

Telegraphists' Textbook

A Handbook of Technical Instruction for Wireless Telegraphists, by H. M. Dowsett; 21s. Published by Iliffe and Sons Ltd.

PROVIDING as it does a thorough theoretical course for the wireless operators' P.M.G. certificate, this textbook covers the theory of wireless communication with very comprehensive explanations of the latest designs of transmitters and receivers. These are solely of the marine type and no items of equipment suitable for aircraft are described. Nevertheless, the principles are, of course, very similar, and only the more modern applications of ultra-high-frequency transmission and specialised direction-finding reception are lacking.

The book has a fairly elementary opening, but after dealing with the theory of electricity and of the operation of the various basic items of radio equipment, the author plunges directly into discussions of modern circuit arrangements. This is actually the sixth edition of the *Handbook*, which was first published in 1913 under a somewhat different title. The present author has been in charge of all the editions since 1915.



IT MIGHT HAPPEN

A Book Inspires Some Thoughts on Bombing by Super-Navigation

By FRANCIS CHICHESTER

I HAVE just read a book which, if read by everybody, would prevent wild panics about air attack, and would also be more effective than all the A.R.P. propaganda in existence.

It would show Englishmen what they are going to be up against in a war against a nation with a powerful air force and a nasty mind. They would realise what must be done for protection to-day and probably for the next century; would jolly well see that it is done, and by that fact do away with any chance of distasteful panics recurring.

This book, *What Happened to the Corbetts*, by Nevil Shute (7s. 6d., William Heineman) is interesting, convincing, realistic and exciting, which is a rare enough combination nowadays—in other words, it is well written.

The opening scene is Southampton. Corbett is a lawyer there, living a typical suburban life with a wife and three children, including a baby. They are woken up by bomb explosions. About a thousand bombs are dropped on the city that night. They do not know that England is at war; they are not even sure who has dropped the bombs.

It is a very rough night, with heavy rain and no visibility. No aeroplanes are seen at all.

"How has it been done?" they ask.

Later it is found out that the enemy have some wonderful sextants. These are shaped like a dumbell, and held in a vertical position. The top knob is an averaging bubble sextant, the grip is a vibration absorber, the bottom knob contains two gyroscopes, electrically driven, which keep the sextant so steady and constantly vertical that positions to within half a mile of accuracy can be obtained with it. As a matter of fact this is the only slip-up on the author's part that I noticed in the book. However steadily vertical such a bubble sextant was held, by gyros or otherwise, it would be subject to horizontal acceleration if the aircraft yawed and the bubble would move in the direction of the yaw under its containing spherical-surfaced lens. This can be demonstrated in a simple way with a bucket of water; no matter how upright it is held, if moved suddenly to one side the water will tend to get left behind, with the result that the water surface level will be tilted considerably from the horizontal. In the sextant of the book, the error induced by a yaw could easily be enough to put the position 12 miles in error.

But that slip does not spoil the book, because a flight of bombers *could* be and will be navigated by means of sextant observation of the stars to within one mile of accuracy, if not to within half a mile.

In the book the bombers navigate by the stars to within about ten miles of Southampton. Knowing their position then to within half a mile, they slip into the clouds, and fly blind until D.R. tells them they are over the city; then they loose off a row of bombs. They streak off home, staying in the clouds and navigating by D.R. till they consider it safe to emerge into the clear. For years I have been asserting that this blind bombing can be and will be done; it is very interesting to me to see it written about by someone else for the first time.

Hundred-pound bombs are spoken of. I suggest that if a bomber carrying 25 bombs of 250lb. each could drop them in a straight line at regular intervals of 50 yards, every creature above ground and every building would be destroyed in a strip 50 yards wide and 1,250 yards long. At that rate, 53 bombers—provided they did not traverse the same ground several times—could utterly destroy a square mile of town and its above-ground population; at any rate, three times that number, say, 150, ought to be enough to obliterate one square mile. The author says that Southampton is about four miles by three, *i.e.*, 12 square miles. At this rate, 1,800 loads of 25 250-lb. bombs each should suffice to destroy Southampton, and possibly in a single night.

Interception fails miserably; on the first night the local squadrons are not expecting anything; next night they are up waiting, but it is fine and no one comes. As soon as the weather is dirty the enemy arrives again in clouds. Not only is our defence unable to find them, but also, because we are *not trained in blind approaches and landing*, we lose far more aeroplanes and pilots through aerodrome crashes and collisions than the enemy loses.

I am sure it would have been cheaper to issue this book in the crisis than five gas masks per family, and more efficacious; but, of course, it has only just been published. I mean that everybody would at once have been incited to take real A.R.P. measures when they read of sewers being blown up, of sewage contaminating everything, and the resultant epidemics of typhoid, and worse; of broken gas mains letting gas loose in the few remaining sewers and blowing up more of them; of no water to drink, no electricity for lighting, no gas for cooking, very little food, no telephones, lack of news, ignorance, rumours; of a cordon round the city to prevent infectious inhabitants from escaping into the country and spreading disease everywhere; of the hopeless ignorance of whether anything was being done to defend the country against the next attack.

The Moral

I won't spoil the readers' excitement by revealing how Corbett exercised his ingenuity to survive.

This book shows clearly why England, from now on, will always have to keep as strong an air force as the great Navy she has had to keep for the past hundred and fifty years.

In 1800 or thereabouts England was, no doubt, in just as much of a funk about being invaded by Napoleon from the sea without warning as she is to-day of being attacked from the air during dinner. In 1800 our big cities and our vital nerve centres were too near the coast for adequate warning of invasion by sea, and our coast was too near enemy harbours stuffed with warships or troops carriers. To-day it is the same problem, but in the air. At the moment the landing of troops by air is not in the enemy programme, but, no doubt, it soon will be.

Our only defence is just the same as it was in Napoleon's time—attack, and the ability to destroy the enemy craft at their bases.

THE ROYAL AERO CLUB

News and Official Notices for *the Week Ended April 1*

Air Defence Cadets

SUCCESS has attended the negotiations between the British Gliding Association and the Air Defence Cadet Corps, and a scheme has been agreed to for training Cadets in gliding at eight clubs. In all, arrangements will be made for 700 Cadets to be trained and the work, as originally proposed, will be done at fortnightly camps. The gliding clubs concerned are: Cambridge, Derbyshire and Lancashire, London, Midland, Newcastle, Oxford, Southdown and Yorkshire.

A basic principle agreed to was that during the running of the camps all machines used for training, other than for "ground hops" must have a current B.G.A. Certificate of Airworthiness. For every camp of 20 Cadets the clubs will provide a staff of four, including one full-time paid instructor. No definite standard of training is visualised for the first year, but the British Gliding Association is confident that if the weather is suitable all Cadets showing aptitude for gliding should reach the "A" Certificate standard, many the "B" standard, and a few even the "C."

General Meeting

THE Duke of Atholl was elected President of the Royal Aero Club at the annual general meeting held on Wednesday of last week, presided over by Sir Lindsay Everard, M.P. Vice-Presidents elected were:—

The Duke of Sutherland, K.T.; The Marquess of Londonderry, K.G., M.V.O.; Viscount Wakefield of Hythe, G.C.V.O., C.B.E., LL.D.; Lord Gorell, C.B.E., M.C.; Lt. Col. J. T. C. Moore-Brabazon, M.C., M.P.; Lt. Col. M. O'Gorman, C.B.

The club committee for 1939 is as follows:—

A. J. A. Wallace Barr; Capt. H. S. Broad; Flt. Lt. C. Clarkson; The Marquess of Clydesdale, A.F.C., M.P.; S. Kenneth Davies; Sir Lindsay Everard, M.P.; Major A. Goodfellow; A. C. S. Irwin; Richard Ince; Capt. A. G. Lamplugh; Major R. H. Mayo, O.B.E.; Lt. Col. Sir Francis K. McLean, A.F.C.; F. Handley Page, C.B.E.; W. R. D. Perkins, M.P.; Major H. A. Petre, D.S.O., M.C.; Capt. R. L. Preston; Major J. Stewart; G. H. Wilson-Fox.

C.A.G. Expansion

SEVERAL proposed new C.A.G. Units were considered by the Executive Committee of the General Council of Associated Light Aeroplane Clubs at its meeting last week, and the Council raised no objections to the following three: Inverness, Swansea, Salmesbury (Preston). Other applications are still being considered.

Flying-club Profits

NEGOTIATIONS are still proceeding with the Air Ministry on the subject of the onerous conditions laid down by the Air Ministry limiting the distribution of profits earned by the clubs operating the C.A.G. scheme. They include a maximum profit rate of 5 per cent. in any one year, and experience at the clubs shows that this is insufficient to attract the necessary capital to enable clubs to equip themselves with the extra aircraft needed for the extended C.A.G. training.

Club Chairman Honoured

SIR KINGSLEY WOOD, Secretary of State for Air, and Air Chief Marshal Sir Cyril Newall, Chief of the Air Staff, were present at a dinner given at the Royal Aero Club on Wednesday to Sir Lindsay Everard, the Chairman of the club. Sir Lindsay Everard has been for many years one of the most generous supporters of private and club flying, and in the House of Commons he keeps a close watch on all aviation interests. He received his knighthood in the New Year honours.

[A report appears on p. 350.—ED.]

On the Air Routes

HOLLAND.—Aeroplane pilots are requested to avoid, so far as possible, flight over the "De Muy" bird sanctuary which is situated 2 *km.* N.W. of *Texel* aerodrome.

GERMANY.—*Rangsdorf* aerodrome is closed to all aircraft until further notice.

FRANCE.—*Abbeville-Drucat* aerodrome is closed to all aircraft until further notice.

Aviators' Certificates

No.	Name	Club or School	Date
17,444	David Young Douglas	Edinburgh Flying Club	19.3.39
17,445	Stenard Ernest Andrew Landale	Edinburgh Flying Club	13.3.39
17,446	John Henry Eric Warner	Midland Aero Club	23.3.39
17,447	Clifton Dare Vincent Sorby	Air Service Training, Ltd.	1.3.39
17,448	Ernest William Curtis	Herts and Essex Aero Club	20.3.39
17,449	Harry Gibson	Newcastle-on-Tyne Aero Club.	21.3.39
17,450	Ronald Percy Band	Southend Flying Club	12.3.39
17,451	James Alexander Robertson	Airwork Flying Club	19.3.39
17,452	Edward Reuben Town	Airwork Flying Club	18.3.39
17,453	Margaret Mary Scott	Leicestershire Aero Club	23.3.39
17,454	Winifred Flack	London Aeroplane Club	22.3.39
17,455	Leslie Robert Betts	Reading Aero Club	23.3.39
17,456	Lancelot Spencer Dobson	Reading Aero Club	19.3.39
17,457	Robert Arthur Jackson	13th Reserve & Elem. Training School, White Waltham.	12.3.39
17,458	Eric John Burley	Tollerton Aero Club	19.3.39
17,459	Stanley George Rivers	Plymouth and Dist. Aero Club.	6.3.39
17,460	Cassandra Felicity Bradford	South Coast Flying Club	20.3.39
17,461	John Frederick Nugent Amis	South Coast Flying Club	18.3.39
17,462	Walter Laurence Stiles	Cinque Ports Flying Club	24.3.39
17,463	William Harry Clinton Davies	Bedford Flying School	24.3.39
17,464	Alfred Gregory	Bedford Flying School	24.3.39
17,465	John Ernest Fowler	Leicestershire Aero Club	24.3.39
17,466	Cecil Carr Young	London Air Park Flying Club.	21.3.39
17,467	Arthur Frederick Lovell	Coventry Aeroplane Club	11.3.39
17,468	David Desmond Richards	Cardiff Aeroplane Club	19.3.39
17,469	Frederick John Joshua	Cardiff Aeroplane Club	24.3.39
17,470	Denis Chappell	Portsmouth Aero Club	24.3.39
17,471	Harvey Nichol	Cardiff Aeroplane Club	25.3.39
17,472	Samuel Leslie Hoffen	Tollerton Aero Club	14.3.39
17,473	Frederick George Averill	Midland Aero Club	24.3.39
17,474	Truey Mary Clarke	Midland Aero Club	24.3.39
17,475	Charles Polwart Turnbull Halliwell	Southend Flying Club	25.3.39
17,476	Walton Miller	Newcastle - upon - Tyne Aero Club.	24.3.39
17,477	Olaf Alfred Eagling	Newcastle - upon - Tyne Aero Club.	24.3.39
17,478	Donald Rose	Strathtay Aero Club	23.3.39
17,479	Eric Stephenson Shepherd	York and Leeming Flying Club.	22.3.39
17,480	Stanley Charles West	Leamington, Warwick and Dist. Aero Club.	15.3.39
17,481	William Taylor Kirkby	Hull Aero Club	15.2.39
17,482	Thomas Alan Carr	Newcastle Aero Club	18.3.39
17,483	Graham Radford Timewell	Blackpool and Fylde Aero Club.	12.3.39
17,484	John Herbert Bolt	Exeter Aero Club	20.3.39
17,485	Frank Gibbs	Exeter Aero Club	25.3.39
17,486	Paul Triefus	London Aeroplane Club	18.3.39
17,487	David Ness	Border Flying Club	27.3.39
17,488	Dorothy Marian Bowe	Doncaster Aero Club	24.3.39
17,489	William Henry Tibbles	Southend Flying Club	26.3.39
17,490	Donald McMartin	Strathtay Aero Club	25.3.39
17,491	James Harold Haselden	Grimsby Aero Club	27.3.39
17,492	Lionel Berman	Grimsby Aero Club	25.3.39
17,493	Harold Marshall	London Air Park Flying Club.	25.3.39
17,494	Peter Stradling	Cotswold Aero Club	22.3.39
17,495	Zita Kathleen Irwin	London Aeroplane Club	28.3.39
17,496	Frederick Roscoe Woodward	Redhill Flying Club	14.3.39
17,497	Frederick Charles Hill	Redhill Flying Club	25.3.39
17,498	Elia Isaakovich Salzman	Redhill Flying Club	12.3.39
17,499	John Roger Seig	Cardiff Aeroplane Club	26.3.39
17,500	Robert Holley Harper	Doncaster Aero Club	27.3.39
17,501	Maurice Stafford Dewing	Norfolk and Norwich Aero Club.	29.3.39
17,502	Margaret Arbuthnot Lane	Romford Flying Club	28.3.39
17,503	Lionel Harding Penrose	Border Flying Club	29.3.39
17,504	Edward Harry Bayliss	Eastbourne Flying Club	22.3.39
17,505	Phillip James Stabbins	Weston Aero Club	19.3.39
17,506	George Wrightson Ibbs	Airwork Flying Club	28.3.39
17,507	James Wood	Malling Aero Club	23.3.39
17,508	John George Mackay	Strathtay Aero Club	9.3.39
17,509	Kenneth Ernest Northcote Mould	Wiltshire School of Flying	29.3.39
17,510	Frank Harvey	Herts and Essex Aero Club	27.3.39
17,511	Albert William Wigglesworth	Doncaster Aero Club	30.3.39
17,512	Frederick Russell Fowler	Eastbourne Flying Club	29.3.39
17,513	Eulalia Olga Mary Rodd	Southend Flying Club	29.3.39
17,514	Albert Mark Taylor	Kent Flying Club	29.3.39

More Work for Scotland

AIR MINISTRY contracts have been placed with some fifteen firms in Edinburgh and East Scotland as a result of the recent Scottish aircraft exhibitions. Companies such as Hawker and Rolls-Royce have also given work to about thirty firms all over Scotland.

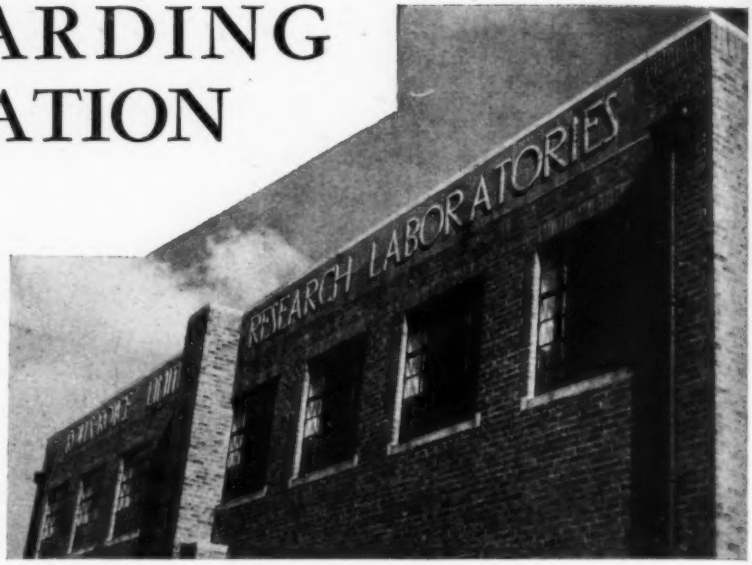
Another news item from Scotland is that the Air Ministry has placed most of the important contracts for the new R.A.F. maintenance factory at Abbotsinch. Lord Provost Dollan, of Glasgow, stated recently that the expenditure would be about £200,000, and that Glasgow firms would be asked to carry out a large share of the work.

SAFEGUARDING A REPUTATION

How Aero Engine Materials are Tested in the Recently Completed Rolls-Royce Research Laboratory

By A. G. DOUGLAS CLEASE, B.Sc.

Illustrated with "Flight" photographs.



The imposing exterior of the new building.

IN the attainment of the vital quality of reliability in aero engines there are many factors to be considered. In the first place, the design must be correct, and it must then be translated into concrete form with the utmost precision which modern manufacturing methods can give. Even so, granted that design and production are of the highest possible order, reliability cannot be achieved unless a constant check is kept upon the specifications of the materials employed.

It is not difficult, therefore, to understand why Rolls-Royce, Ltd., should maintain three laboratories at their Derby works. One is primarily concerned with the testing of materials as received from suppliers. Another watches over what may be described as ordinary production problems. The third is, perhaps, the most important of all, since it bears the title of research laboratory. In it is conducted development work on new alloys and materials, and solutions are also sought for the more complex problems which come to light during production.

The research laboratory has only recently been completed, and it is a light, airy building of two storeys with each floor divided up into various departments, each dealing with different sets of problems. The laboratory has been laid out and equipped with two ends in view: (1) To assist the foundry and to deal generally with light metal problems as they are encountered in the works; and (2) to develop new, and improve existing, light alloys for future use as they are proved to be suitable for the purposes for which they are intended.

On the ground floor there are a chemical laboratory, a furnace room, a mechanical test room, an X-ray room, a micro room and a macro room, as well as a very necessary machine room and a dark-room.

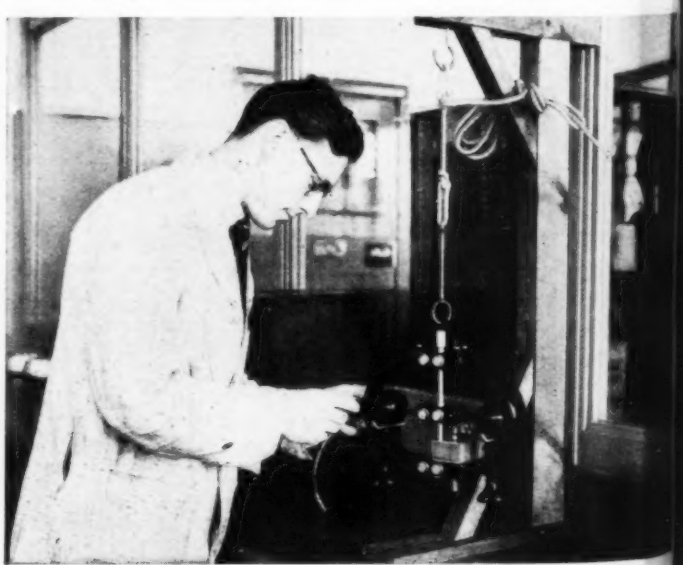
Chemical analysis in such a laboratory is concerned with a wide range of problems. In the first place, there is the routine checking of all materials employed, to ensure that they reach the high standard imposed. Indeed, the analytical chemist plays an important part in controlling the products of the foundry, alongside which the research laboratory stands.

Another essential activity is the development of new methods of analysis to deal with the constantly increasing diversity of the materials used. It is, for example, necessary to carry out chemical analysis on lubricating oils, corrosion products, inclusions in castings, refractory materials, sands, fluxes and gases. In view of the varied nature of the problems there are actually two chemical laboratories in the research building, the one on the ground floor dealing principally with the analysis of light alloys and sand, and the other on the upper floor being more intimately concerned with development and research work.

Actually, the chemical and physical qualities of sand for casting are important. If, for example, when the sand is rammed into a moulding box, the particles are of a rounded nature, then obviously they could not be expected to adhere with such strength and tenacity as would be obtained if the particles were of an irregular shape.

Accordingly, various sands are subjected to chemical analysis; their water content is tested, the amount of clay they may contain is determined and the size and shape of the grains is examined. The hardness and strength of test-pieces moulded out of the sands are noted, these test-pieces being subjected to both compression and tensile tests. The permeability of the sand is also tested.

In the furnace room there are provided gas, electric and high-frequency melting furnaces in order that the melting and casting of alloys may be studied under different conditions. Investigations can also be carried out on heat



Determining damping capacity of a test-piece clamped in a machine designed for the purpose by the Cambridge Instrument Co.

The staff of the research laboratory. In the centre are Messrs. T. F. Bradbury, H. C. Hall (in charge) and H. Gresham.

treatment in order to determine its effect upon the strength and other physical qualities of light alloys. In the high-frequency furnace the metal is melted by means of the heating effect of eddy currents induced in it. "Electroflo" automatic control is fitted to a number of the furnaces.

In the mechanical test room an Avery automatic Brinell machine has been installed, the impression of the test-pieces being made under identical conditions each time, since the operation is electrically controlled. The test-piece is placed on the anvil and raised until it is almost in contact with the ball, and then, on pressing the starting button, the load is applied for a period of fifteen or thirty seconds, as selected by previously operating a two-way switch. When the predetermined time period has elapsed the machine stops automatically and the indentation in the test piece is examined under a microscope and measured in the usual way.

Also in this room there is a Vickers hardness-testing machine in which the indenting tool is a pyramid-shaped diamond. A system of levers applies the load, which is automatically governed by a trip release. The diameter of the impression is then measured by a microscope with moving shutters.

An Avery Izod impact tester is also provided and two tensile testing machines are being installed. One of these is for measuring automatically the linear variations of the test-pieces during the full test period by means of an optically functioning time and elongation recording apparatus. Long hot duration tests from 200 deg. C. to 700 deg. C. are carried out in an air-circulating electric furnace with an automatic control which gives a maximum variation in temperature of plus or minus 20 deg. C. Owing to the large magnification of the measuring device employed an elongation as small as 0.00004 in. can be read clearly from the recorded diagram.

Particularly well equipped is the X-ray department, with its Philips Metalix Macro 150 mobile unit, which is capable of an output of 150 kilovolts or 20 milliamps continuous, and by the addition of a further generator can be given an output of 300 kilovolts or 10 milliamps for the examination of steel. The plant has a self-protected shockproof water-cooled unipolar type of tube which gives good flexibility in use, and it is particularly useful for the examination of light alloy castings up to a maximum thickness of 4 in. By the use of this plant, oxide inclusions, shrinkage, blow-holes, cracks, segregation and other defects in the castings are shown up with the maximum of detail.

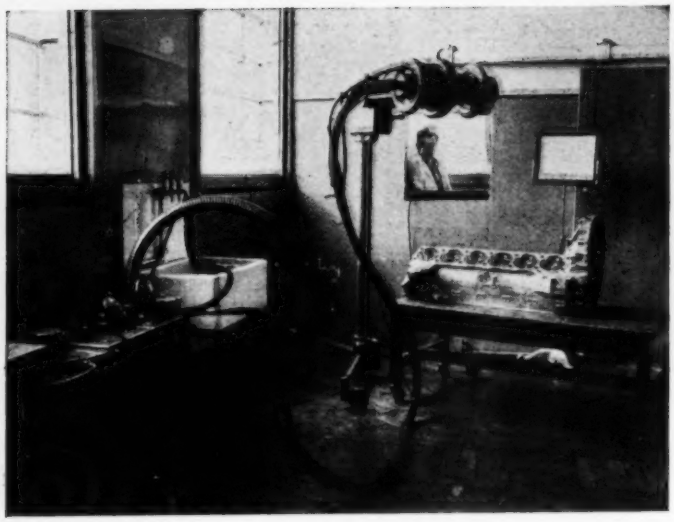
X-Ray Protection

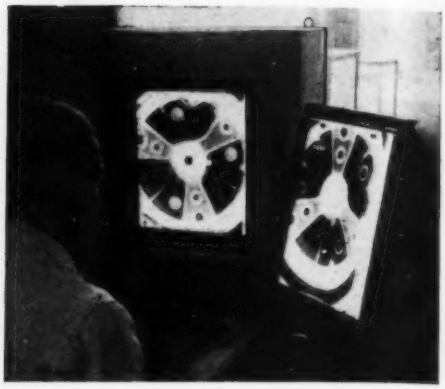
As some of the castings to be examined are too large to be dealt with in the type of screening stand generally employed for industrial radioscopy, the plant is arranged so that the operator and the controls are screened off in a safety zone from the object to be examined and the source of radiation. The walls of the X-ray room are covered in 4 in. of barium sulphate plaster with a lead equivalent of 9 mm. The ceiling has four tons of lead laid between concrete, and the entrance is through a sliding door of lead carried on ball bearings. The safety zone has a lead screen which has been welded into position, thus avoiding any cracks or screw holes through which leakage might occur, and the bottom of the lead is curved under the concrete foundations of the teak block flooring. An inspection window 2 ft. 6 in. square is composed of four sheets of lead protective glass.

The microscopical examination of metals in order to observe their construction is, of course, important, and in the micro room there is a Vickers projection microscope of the inverted type. Magnifications up to 4,400 times are obtained. A Zeiss binocular microscope is also used, and in the same room there is a Hounsfield Tensometer which is used for making tensile and other tests upon small specimens having a cross-sectional area from 1/80 sq. in. to 1/5 sq. in. The advantage of this Tensometer is that small specimens about 1 in. in length may be taken from a number of different places in the same casting or forging, machined to the required dimensions as test-pieces, and then tested. As the specimen is subjected to load the stress is recorded by a mercury column in a tube alongside which is a calibrated scale. At the same time, a rubber-surfaced cylinder is caused to rotate and to it is fixed a prepared chart paper. As the different readings are taken a pointer is moved opposite to the meniscus of the mercury column, and then a stylus is depressed, recording a definite point on the chart so that an autographic record of the stress-strain curve is produced.

In the macro room, as its name implies, there is equipment for macro-etching specimens of material so that examination may be made of coarser structural features, such as the crystal-

Intermittent immersion tests for corrosion. The test-pieces fixed to the discs, are immersed in the liquids every ten seconds as the discs revolve.





(Above) Inspection of illuminated radiographs. (Left) Radiographic examination of a crankcase casting by the Philips equipment. The complete plant is lead-screened for safety.

lisation and porosity in castings and the direction of lines of flow in forgings and stampings.

The machine tool room is, of course, essential for the preparation of test-pieces for tensometer and impact tests, for sectioning castings for macro and micro examination, and for the construction of intricate pieces of apparatus for investigating specialised problems.

Also essential is the dark-room, which is of very modern type with a light-lock so that doors are eliminated. The dark-room is itself divided into two sections, one for radiographic processing and the other for micro-photography work. As in the other rooms, air conditioning maintains the temperature at an even 65 deg. F.

On the first floor there is the second chemical analysis laboratory previously referred to, and in this the subject of corrosion is also investigated. The main corrosion rigs are nine in number, and specimens of the materials under test are hung from rotating discs, which are inclined at an angle of 45 deg. to the vertical. The discs are driven by electric motors through suitable reduction gearing, and as they revolve the specimens are immersed in the corroding liquid once every ten seconds. The corroding effect of various liquids is investigated; for example, the ordinary water supply, salt solution, ethylene glycol, and so on. Spray and impingement corrosion tests are also carried out.

In another room on the first floor the work of a physical laboratory is carried out, such properties as thermal conductivity, the coefficient of expansion, specific gravity, Young's modulus and specific heat being determined.

Fatigue and Creep

Fatigue testing is of particular importance, as metals often fail due to the fact that they literally become fatigued or tired under stresses which are lower than the accepted figures for strength. There are seven fatigue-testing machines, and they are equipped with furnaces and temperature control. The load is applied to a transverse test-piece by means of a knife edge operated by a spring which is compressed by a cam rotating at 1,000 r.p.m.

A battery of "creep" testing machines has also been installed, for under certain conditions metals actually flow under very low stresses. There are six creep test machines, and these also are equipped with furnaces and control equipment, so that the metals can be tested at the temperatures actually experienced in internal-combustion engines. A test-piece in the form of a small beam about 1¼ in. long has the load applied transversely by means of a knife edge, lever and weights. Creep is measured by a differential method and the use of an optical lever.

For the determination of expansion, a bar of material 15 in. long is heated uniformly by means of an oil bath. The expansion is measured by means of a micrometer reading to 0.0001 in.

For the investigation of thermal conductivity heat is put in at one end of a bar and the quantity travelling along measured by a constant-flow water calorimeter. Thermocouples are used to determine the temperature gradient along the bar, and external loss of heat is prevented by a guard ring which has a temperature gradient corresponding to that of the bar. The results are correlated with electrical conductivity as determined by a Kelvin double bridge.

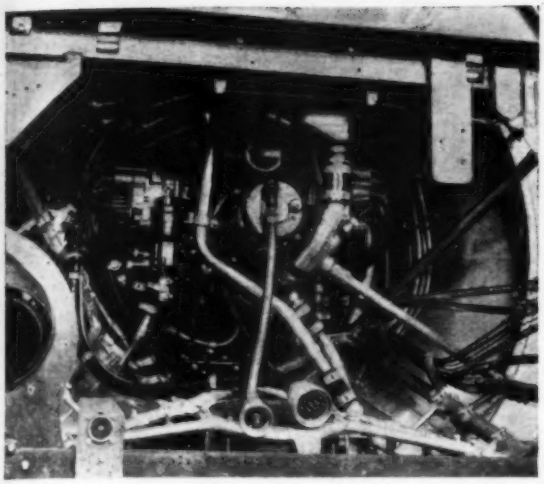
In order to investigate the damping capacity of various metals a damping capacity machine of the torsional type designed by the Cambridge Instrument Company is employed. In this the test bar is fixed at each end, while the middle is clamped to a heavy metal dumbell. The bar is made to oscillate and a stylus carried by the dumbell records the amplitude of the vibrations on a celluloid disc. On examination of the celluloid disc under a microscope the loss of amplitude is measured and the damping capacity can then be calculated.

Friction is investigated by two friction test machines. In these an electric motor operates through a suitable drive a rotor in which are held four cylindrical test-pieces in such a manner that the end of each test-piece rubs against a stationary disc. The materials of test-pieces and stationary disc can be chosen and changed as required. The rubbing surfaces are immersed in an oil bath which can be heated so as to obtain the desired temperature of operation, and the desired load can be applied by means of a system of levers and a spring. On one of the two machines the load can be partly relieved for alternate revolutions. The speed at which the testing rig is driven is measured by a revolution counter and the power absorbed in driving the rig by an ammeter. The oil in which the rubbing surfaces are immersed can be examined chemically for wear products, and the surfaces of the test specimens and of the rubbing disc can also be viewed.

In a bearing test machine a straight shaft is driven by a variable-speed electric motor through a suitable gear box and coupling. The shaft is arranged to receive three bearings. The centre bearing reproduces the conditions of a main bearing, there being no load on it except that introduced by the shaft. The other two bearings can be given a direct loading by means of levers and weights, and also, at the same time, an alternating load is produced by springs which are cam operated. Oil is circulated into the main bearing and along the shaft to the two end bearings, in which, obviously, the cycles of a big-end bearing can be reproduced. The temperature of the bearings is measured by thermometers in the housings, and the power absorbed in driving the machine by a Watt-meter.

There is also a torsional fatigue tester, in which a test bar—under heat, if necessary—can be set into torsional vibration by means of a motor-driven cam and lever operated by an electric motor.

Another small machine reproduces the conditions pertaining to a valve stem and its guide and an ingeniously simple rig has been devised for testing hot scaling.



This photograph of an early Pegasus installation gives point to Mr. Nixon's observation on the sudden growth of accessory-drive complication a few years ago.

ANCILLARY POWER SERVICES

Problems of Reducing the Present Complexity of Hydraulic, Pneumatic and Electric Equipment in Aircraft : R.Ae.S. Paper by R. H. Chaplin and F. Nixon

MORE than once in recent years *Flight* has criticised the ever-increasing complexity, cost and weight of ancillary power services in aircraft, and military aircraft particularly. It is a problem that would most certainly become a grave one in the event of war, for the intensive "plumbing" that is now customary might seriously hamper production.

Aircraft and engine designers are thinking along the same lines, and last Thursday, in a joint paper before the Royal Aeronautical Society, two of them presented some extremely pertinent criticisms and suggestions.

Mr. R. H. Chaplin, B.Sc., A.F.R.Ae.S. (assistant chief designer in the Hawker organisation), and Mr. F. Nixon, B.Sc., A.F.R.Ae.S., who for the past ten years has been engaged on engine development and design with the Bristol Company, put forward ideas, each from his own particular angle, and their opinions suffered no loss of value by the fact that they were occasionally in conflict.

As was to be expected, the subsequent discussion (which we hope to summarise in next week's issue) was an animated one. The following is a précis of the paper.

Mr. Chaplin started by mentioning what might be called the earliest aircraft power service, the electrical system which derived its power from a windmill-driven generator. With the demand for more power and aerodynamically cleaner aircraft the windmill gave place to the engine-driven generator. The next step came with the introduction of pneumatic brakes, which were first fed from an air storage bottle. Ultimately an engine-driven compressor was added to keep the air bottle charged.

More recent was the development of retractable undercarriages and flaps, for which hydraulics met with immediate and fairly general adoption and for which an engine-driven hydraulic pump was practically essential. Lastly, there was the modern tendency to use a vacuum pump to overcome the icing and other difficulties associated with the use of venturis for driving instruments.

Thus we had four main services, namely, electricity, compressed air, hydraulics and vacuum. These four services were further complicated by the fact that each had its variations in matter of pressure.

The first question was, "Are all these services essential?" The answer was, "They are not." Which ones could be eliminated?

After outlining primary requirements of a comprehensive power service, Mr. Chaplin showed that the electrical service must obviously be retained and went on to argue that only one of the remaining three systems (compressed air, hydraulics and vacuum) need be retained. This was hydraulics and, using it together with electricity, they could satisfactorily perform all necessary tasks.

As regards reasons for supplementing electricity with hydraulics, first and foremost was the question of weight. The electric motor was heavy as compared with the hydraulic jack. The jack was dependent upon the amount of energy per stroke it was capable of handling and not upon the horse-power developed. Thus, a small jack of 1in. bore by a 4in. stroke operating during part of its stroke at 2.2 h.p. (which was the horse-power developed by the Lockheed Mk. IV. hydraulic pump at 1,400lb./sq. in. at 1,300 r.p.m.) would weigh about 1.5lb. whereas an electric motor with the same power would probably weigh 15lb. Where more or less continuous operation was required there was still a saving in favour of the hydraulic unit, since light and efficient hydraulic motors were now in existence.

The lecturer next enlarged on some other advantages of hydraulic units, including their facilities for instantaneous stopping and starting, variation of gear ratio by modifying the bore and stroke of the jack and ease of limiting the force supplied to a mechanism by the provision of blow-off valves.

Mr. Chaplin proceeded to question whether vacuum and compressed-air services could not be satisfactorily replaced by electricity and hydraulics. It was not impossible, he said, to obtain satisfactory results with electrically driven gyros and there was at least one automatic pilot, the French Alkan, which was so operated.

Passing to the third question—whether there was sufficient justification to warrant the elimination of compressed air and vacuum, Mr. Chaplin said:—

"Some simplification and reduction in the number of services is essential for cheapness, standardisation and production and it appears to me that the claims of vacuum and compressed air for retention are very small. From the aircraft designer's point of view it must be an advantage to effect so great a reduction in the number of types of services. Pipe systems, with their multiplicity of materials, gauges, couplings, valves, etc., would be considerably reduced, thus avoiding the necessity for specialisation in so many directions in a design staff. The stores and works problems must also be inevitably eased. Again, from the aspect of maintenance, this elimination of two services cannot fail to be an advantage both with regard to training and operation of personnel. Perhaps, however, as great a saving would be amongst the engine people and those in official authority whose business it is to approve the various accessories associated with these two apparently non-essential services.

"Although by no means a universal opinion, I find many people feel that for such-and-such an application the so-and-so service is ideal and that it will not be possible to design a mechanism so efficient as the present type if a particular form of power service is eliminated. This, I feel, is merely adopting a defeatist outlook, making any change from existing standards impossible. A certain lapse of time is, of course, necessary to develop new designs, but I do not think we should lose sight of the fact that small sacrifices, with regard to virtues of the old design, may be worth while if some simplification is achieved."

The lecturer next considered an aspect which had a vital bearing on the whole subject, that of using a separate auxiliary power unit comprising a petrol engine of, say, 30 h.p. coupled to an electric generator and perhaps a hydraulic generator. Possibly the advantages were considerable and fairly obvious, but it could not be said that it was of much advantage to the aircraft designer; all he wanted was a service, and the less interference with the layout of the aircraft the better. Such schemes had been applied to certain aircraft in America, and he believed he was correct in saying that they had not proved an unqualified success. He felt that their greatest disadvantage would be in connection with small- and medium-sized aircraft.

Intimately bound up with this question was that of the claims being made for the use of high-frequency high-voltage alternating current. After setting out these claims Mr. Chaplin proceeded to put forward what he considered to be some disadvantages, and urged that it would not be wise to stray far from accepted standards without extreme caution. He also put forward objections to the use of alternating current of normal voltage and frequency. He submitted that the case for alternating current in any form was not good enough—it was better to deal with the devil they knew than with the devil they did not know.

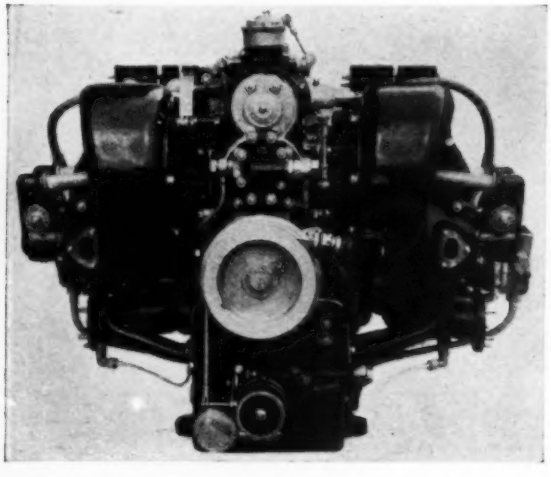
Returning to more general problems, they might assume they had an electrical generator and possibly a hydraulic generator driven off the main power unit or units. Broadly speaking, there appeared to be two methods of arranging this: one was to have a single drive to an electric generator to provide all the energy necessary to operate the other power services, and the other was to have two drives on the engine for electrical and hydraulic generators respectively. Examining details, the lecturer said that it hardly seemed reasonable to have a relatively large generator on the engine and then install an electric motor of almost the same power as the generator to operate the hydraulic pump. These observations brought them automatically to the second alternative, which seemed by far the most practical compromise. Mr. Chaplin continued:—

"The suggestion is to drive two generators, namely, an electric and a hydraulic one, from the engine. Preferably these should be mounted on the engine itself provided the overall shape and dimensions of the engine unit were not unduly affected. One of the main reasons for the separate gear box unit disappears, as the number of service connections to be broken when an engine is removed is so few as to be little trouble. Should, however, the installing of the units on the engine itself prove an appreciable source of trouble to the engine people, these same two generators would have to be mounted on a separate gear box.

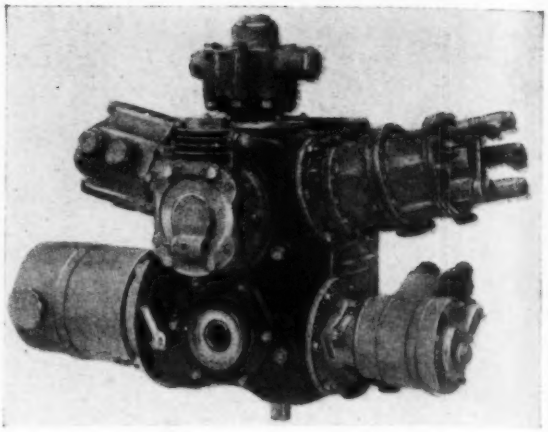
"Almost immediate application of the scheme can be achieved by utilising small electric motor-driven units in the aircraft for vacuum and compressed air where there has not been sufficient time to redesign certain mechanisms to operate electrically and/or hydraulically, and there is no satisfactory existing design so operated.

"The fact, also, that there are in existence certain hydraulically operated units designed to work off a low-pressure hydraulic service at 300 lb./sq. in., in addition to the more general hydraulic service at up to 1,400 lb./sq. in., need not constitute a difficulty. These two services working at such different pressures are not generally to be found on any other than multi-engined aircraft, in which case a high- and a low-pressure hydraulic pump would be driven respectively by each of the engines of a twin-engined machine."

Mr. Chaplin said that it might come as a surprise to many to know that aircraft were under construction to-day which carried hydraulic equipment weighing nearly half a ton and comprising as many as five independent hydraulic services. Surely something should be done to make it possible to avoid this sort of thing. As regards future development, the necessity for standardisation came first. Next was the necessity for higher pressures, which would permit a reduction in the size of the fittings and the amount of oil carried.



Both lecturers discussed the claims of the auxiliary engine for supplying service power. This is a well known British example, the A.B.C. flat twin.



One neat approach to the problem—the Bristol six-unit accessory gear box.

Instantaneous Response

Another point for attention was to ensure that energy should be available for immediate operation without time lag. In other words, it was desirable that, running through the aircraft, there should be a hydraulic main always maintained slightly above the working pressure, oil being diverted to the working circuits when required. Certain disadvantages associated with this scheme could be overcome by the use of a self-regulating pump working on the variable-stroke principle.

As regards emergency supplies, the pneumatically loaded hydraulic accumulator provided a ready solution, and in any case it was a comparatively simple matter to arrange a cylinder of compressed gas to provide the necessary motive power for a jack. To obtain a similar result by storage batteries in an electric circuit would involve prohibitive weight. Manually operated emergency mechanism had grave shortcomings for high-speed operation.

Mr. Nixon, speaking as an engine designer, said that he intended to make his views complementary to those of Mr. Chaplin. In preparing the paper he had been greatly assisted by accessory firms in this country, France, Germany and the United States, and their extremely generous response to requests for information had indicated that the firms themselves were anxious to arrive at a satisfactory solution of the problems of mounting accessory drives on power plants.

After reviewing, as had Mr. Chaplin, the ever-increasing demands for power services, Mr. Nixon said that about four years ago it became evident that with the increased adoption of retractable undercarriages, of flaps and of gun turrets, much more power would be required. With engine

types already in production, the only solution was to add one drive after another as the various pumps, etc., came along. He referred to a well-known type of engine as having become "a sort of Christmas tree." He felt that round about that period the firms specialising in hydraulics missed some opportunities for standardisation, though admittedly they were pressed for time.

Going on to review the pros and cons of pneumatic (high- and low-pressure and vacuum), hydraulic and electric systems from the engine constructor's point of view, Mr. Nixon said that his main concern was the quantity of power required and the way in which he could best provide that power. On a twin-engined bomber of 20,000 lb. all-up weight a total of about 12 h.p. must be available, while a machine of 60,000 lb. required a total of about 30 h.p., with a maximum instantaneous demand for about 12 h.p.

Two possible sources of power were available, the main engines themselves or a small auxiliary. Showing how the rear covers of engines had become overloaded with accessories, the lecturer cited eleven different items which had to be accommodated on one of the engines of a twin-engined bomber with three turrets. He said that a recent development was the provision of an accessory gear box, which greatly simplified matters, facilitating installation and enabling accessory drive speeds to be standardised.

As compared with the auxiliary power unit, main-engine drive had the important advantages of weight-saving and of maximum reliability through duplication. On the other hand, it meant complication of nacelle layout, the inability to provide other than direct current and the fact that accumulators must be carried for starting purposes. Main-engine drive could, however, be used for A.C. generation by employing a variable-speed drive with a governor to keep the alternator speed constant at the gliding speed of the engine, though it was unfortunate that a large proportion of the total power required was wanted at gliding speed, e.g., for radio, undercarriage, lighting and heating. Nevertheless, a system might be evolved using either a mechanical variable-speed transmission or, rather paradoxically, a hydraulic variable-speed pump and motor between the engine and the alternator. This would compete on a weight basis with the auxiliary power unit, though the latter scheme had the advantage of greater flexibility of installation.

The Alternator System

Mr. Nixon gave some figures to justify his advocacy of the alternator system and said the total weight of the installation would be about 80 lb. or 26.6 lb. per kiloWatt. While installation would be difficult, the hydraulic motor and the alternator could be housed within the wing or the nacelle. On smaller machines cartridge starting would be employed, while on larger ones an auxiliary unit for that and other purposes would be justified. The lecturer went on to present in some detail his ideas on the layout of such an auxiliary unit. A better case could be made out for it, he said, if it were used in a subsidiary capacity only, in conjunction with main-engine drive. By driving the bulk of the accessories from the main engine and using the auxiliary engine only for those units required for starting and ground operation, the engine could be reduced considerably in size and weight. If alternating current were adopted, it should be possible to produce 3kW. for a total weight of about 75 lb.

The lecturer concluded with the following remarks:—

"The first step in providing a solution to the problem before us is to reduce the number of different types of power to a minimum. . .

"The kind of power used for the mechanical work in a particular aeroplane will depend upon the size and type of the machine, and the other services required. It can be taken as axiomatic that, *for maximum economy, if a particular kind of power must be used for a certain service, then other uses should be found for it in order to bring the load factor up to the maximum value possible.*

"This point is extremely important and cannot be over-emphasised. Load factors of some of the services are extremely low. For instance, to start an engine requires 3.6 kW. for 3 seconds. To raise the undercarriage of a large machine electrically calls for 4.8 kW. for 50 seconds, while the whole of the continuous services, including wireless and lighting of a large passenger cabin requires only about 2 kW.

"With large aircraft, and particularly in the case of civil machines, a great deal of electricity is needed (for lighting, wireless and cooking). Here it is probable that the electrical energy already available will be extended to the retraction of the undercarriage, wing flaps, bomb doors, and remote drive for turret pumps, offering a saving in weight, or greater convenience, over a hydraulic system, particularly if an A.C. supply is available.

"Operation of brakes is best effected by hydraulic means, but the pump providing the oil is used only during take-off and landing, so that other uses should be found for this pressure oil during flight. We may have, therefore, hydraulic power applied to undercarriages, gun turrets, flaps, and bomb doors, to a greater or lesser degree, and electricity, in addition to starting, wireless, and lighting, may also be applied to some or all of these duties. . .

"I would suggest that in the near future we shall see compressed air replaced by oil, and oil pressures standardised at two values, say 3,000 lb./sq. in. for brakes and jacks, and about 1,000 lb./sq. in. for gun turrets. Vacuum for instruments, and low pressure air for wing de-icers, may be retained, but this will depend upon developments in these two groups. Electricity is well established, and its application is likely to be extended. I do not feel qualified to express an opinion on the relative merits of D.C. and A.C., but should the claims of those experts who point to the reduction in weight, the freedom from sparking, and the ease of conversion given by A.C. be borne out, then I see no particular difficulty in providing drives for the generation of this current. Whichever current is finally adopted, however, it is important to insist on its standardisation on all aircraft.

Reviewing Electrical Possibilities

"Assuming for the moment that the use of high-voltage alternating current is justified, it does not seem likely that it will be widely adopted for military aircraft until some satisfactory means has been developed for driving alternators from the main engine. This would not only reduce the weight of generation appreciably, but it would also allow of standardisation of instruments and equipment throughout a wide range of aircraft sizes. For the present, bearing in mind the time taken to establish a new development, it appears likely that 24-volt D.C. will persist. For the future, it is suggested that a thorough review of the merits of 24-volt D.C., 24-volt A.C. and 110-volt A.C., be made before embarking on a programme of development. . .

"It is the manufacturers of large aircraft who should be most favourably disposed to an extension of the application of electricity and the makers of smaller high-speed machines who should favour hydraulics. . .

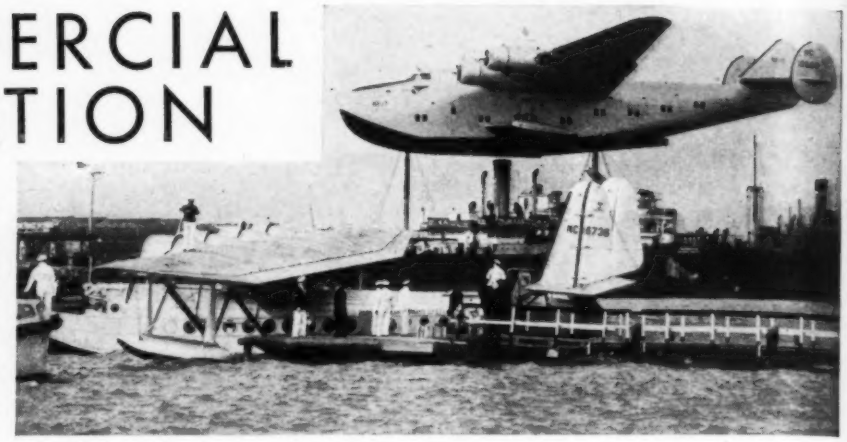
"The concentration of all the accessories in a central group is not thought to be expedient. Duplication is essential for safety, and the installation of the auxiliary power unit introduces difficult problems such as sound-proofing, which are particularly important in civil aircraft. The system is, moreover, unduly large and weighty. For instance, the production of 13 kW. on the Douglas D.C.4 requires a total weight of 647 lb., involving as it does duplication of the auxiliary units and running throttled on the ground.

"With the development of accessory gear boxes and quickly detachable power eggs, many of the objections to main-engine drive disappear. For the immediate future, it is suggested that the solution lies in the use of standardised oil pressures, and 24-volt direct current, the oil pumps and generators being mounted on accessory gear boxes. Vacuum pumps will have to be retained for the present.

"Possibly the ideal solution is a constant-speed hydraulic drive enabling an alternator to be driven from the main engine, together with a small auxiliary engine-alternator group. . . . This scheme would extend the use of alternating current down to a much smaller size of machine than could accommodate the central power group. . . .

"The solution of the problem on rational lines is largely in the hands of the manufacturers of accessories."

COMMERCIAL AVIATION



READY FOR THE CROSSING: The Boeing 314 *Yankee Clipper* cutting things fine while making an approach at Baltimore after flying over from San Francisco. The machine at the landing stage is the Sikorsky S.42B *Bermuda Clipper*, which is now being assisted on the Bermuda service by the second of the 314s, *Atlantic Clipper*. At the time of going to press *Yankee Clipper* was at Biscarosse.

THE WEEK AT CROYDON

"A. Viator" on Service Cloud Flying, the Refugee Scene, the Omniscience of Cricket, and an Admonition from the Powers-that-be

PILOTS of the airlines are to go in terror of their lives regularly every Tuesday afternoon from now to the end of August: Royal Air Force machines will be flying in cloud and bad visibility at most heights which matter and the air transport pilot is the very first to agree to this, dangerous though it is bound to be, if he is convinced that it must necessarily be done all over the air routes.

But must it? If this Service flying is done in cloud and bad visibility, does it really matter what sort of country is beneath them? If not, why not ship the whole outfit to some stretch of sky where there is little or no risk of collision with commercial craft? I am informed that there are very good lines in cloud formation in other places and if you need extra-quality cloud with some body to it some of our manufacturing centres run a line which in taste, smell and colour closely resembles vapourised stout. Ah well! What can't be cured must be endured; but *can* one endure a 350 m.p.h. fighter going straight through the cabin, in one side and out the other?

I doubt if the newspapers have done anyone much service by booming the story of the returning refugees who created such a disturbance at Croydon last week that the pilot of a Danish machine refused, for safety, to carry them.

Soft-hearted people came forward and arranged to guarantee these people, I understand, because of the sob stories in the papers. But wait a moment. I have seen many a party of refugees accept the decision of the authorities with pale, set faces and I have seen them embark with control and dignity. Nobody came forward to help *them*, because they did not kick and scream and refuse to walk. This means putting a premium on hysteria and on an utter loss of control by parties of men who behave like small children confronted by a bogy. Are these the sort of people we want to help, as much as we want to help the finer, less hysterical types? We shall get lots more kicking and screaming now, of course, because the news will have spread that those who so behave are permitted to stay here.

Oh, these English! Just when the last crisis was really thickening up and in some countries you couldn't hear the road drills for rattling sabres, I was informed (with reverence) of a cricket team setting off in *Falcon* from Croydon for Marseilles, where they would pick up an Empire boat and fly on to Alexandria. Games had been arranged with Alexandria and with Alexandria Airport team, largely composed of Imperial Airways people and with other teams and play was to take place at Aboukir. There would have been a crisis all right if anything had interfered with the teams, whose journey, I am happy to announce, was excellent.

Works and Bricks get more cunning every week. They don't dig pits for aeroplanes now, but for motor cars. They do this is front of the main building, where a shrubbery was and a car park will be. One well-known Airport official stepped from his car on to a bit of tinfoil cleverly disguised with sprinkled earth and suddenly disappeared into our quite extensive drainage system without a word of farewell. Otherwise W. and B. policy remains the same, which is loudly to disclaim any further territorial ambitions on the aerodrome and then to grab a big area and mark it off with flags so that we cannot use it.

An Air Ministry department has taken me to task somewhat after the manner of the Archbishop of Auchtermuchty admonishing an errant choirboy. I am impressed by the manner but not by the matter of this reproof, for I am accused of criticising the Air Ministry for doing nothing about the 300ft. chimney near Croydon Aerodrome, which I said was a serious menace to life. I am told that I should not have made this criticism, because the scheme has been washed out for some time.

Secret Service

Now, the department in question has access to official secrets while I have not, and therefore I would emphasise that no air traffic company, Imperial, British Airways, K.L.M., Air France, Swissair, or any other operating at Croydon, has been advised by the Air Ministry that the chimney scheme has been abandoned. The last any company heard from the Ministry was a circular letter, lacking even the human touch of a handwritten signature, stating that the chimney would be built and offering no hint that the Ministry would fight this monstrous proposal. The letter was dated January 17, 1939, and ended with the gelatinous remark: "In view of the proximity of the proposed chimney to existing air routes, it is thought that your company would wish to be informed of the scheme." Not only that, but several companies promptly wrote vigorous letters of protest and I know one company which has not, up to the time of writing, had the courtesy of a reply from the Ministry.

No wonder, then, that I wrote last week under the firm impression that nothing had been done. And by the same token I am convinced that nothing would have been done if the companies had not taken a strong line. Now I expect I shall be excommunicated by another department of the Ministry for announcing the abandonment of the chimney scheme before it has filtered through to the companies officially.

But cheer up, chums of the Air Ministry, we all make mistakes at times. Why! bless you, I made one myself last week. In referring to the Stockholm-Moscow service I forgot to mention that it does not start until May

Still More

AMONG the summer service plans which have been issued by the various European operating companies, those of K.L.M. are as comprehensive as any. There will, for instance, be eight services every day in each direction between Croydon and Amsterdam, these including the ones operated by A.B.A. and D.L.H. The Scandinavian Air Express will run twice daily from Croydon to Stockholm, K.L.M. running this in pool with A.B.A.

Additionally, a twice-daily service will also be run from Croydon to Rotterdam, Prague, Vienna and Budapest, and there will be three services every day between Croydon, Amsterdam, Bremen, Hamburg, Hanover and Berlin, this again being in pool with D.L.H. Finally, K.L.M. will shortly be restarting a daily summer service between Liverpool, Manchester, Doncaster and Amsterdam.

In Iceland, Too

ICELAND has long enjoyed an almost complete immunity from the political disturbances with which Europe is intermittently afflicted, and it seems its inhabitants are not unconscious of their blessings in this respect.

A few weeks ago curious stories were in circulation about a German geological expedition which was engaged in making extensive surveys in that country. Simultaneously, German ships were busy making soundings in the fiords.

Suspicious people among the Icelanders were sceptical of the scientific explanations, and asserted that the geologists were actually searching for suitable air bases and the oceanographers for suitable submarine resorts. Apparently there has been a sequel. On Monday of last week representatives of D.L.H. arrived at Reykjavik to negotiate for the establishment of a German air base, and on Thursday the Iceland Government issued a communiqué stating that they were determined not to concede the rights to any foreign power.

Passengers from Montreal to Vancouver

ON April 1 Trans-Canada Airlines ran the first trans-Continent passenger air services between Montreal and Vancouver. From now on this 17½-hour service is being run daily in each direction. During the past six months regular semi-experimental mail flights have been made over the route. Air mail schedules by day between Winnipeg and Vancouver started last October and were extended into eastern Canada in December, while on March 1 an over-night mail run was started between Montreal and Vancouver.

On Saturday Lockheed Fourteens left Montreal and Vancouver simultaneously to cover the 2,688 miles between these points, making stops at Ottowa, Toronto North Bay, Winnipeg, Regina and Lethbridge. Needless to say, this new service will link up with the Imperial Airways Atlantic mail services at Montreal. When and if passengers are carried over the Atlantic the time taken to travel from Foynes to Vancouver will be in the region of forty hours.

Unitwin in Service

ONE of the new Vega monoplanes, made by a subsidiary of the Lockheed Corporation, has been ordered by Mid-Continent Airlines for passenger services on the northern part of their run between Kansas City, Fargo and St. Paul.

This order is particularly interesting because the Vega has been built round the Unitwin engine, which consists of two Menasco in-line air-cooled engines lying side by side and geared together through a clutch mechanism to a single constant-speed airscrew. By such means the reliability of a twin-engined type is available with a single engine layout. This first Unitwin engine has a take-off power of 590 h.p., and the five-passenger Vega monoplane will cruise at 184 m.p.h. The first machine is expected to be taken over by Mid-Continent Airlines early this summer.

A number of figures for this Vega monoplane have recently been issued by the Vega Airplane Company. In brief, these are: Span, 41ft.; length, 32ft. 5in.; all-up weight, 5,750 lb.; maximum speed (at 7,500ft.), 210 m.p.h.; cruising speed, 184 m.p.h.; initial rate of climb, 1,350 ft./min.; and absolute ceiling, 23,500ft. It will be fitted with a retractable tricycle landing gear, but will otherwise be a fairly conventional modern low-wing machine, with trailing edge flaps and twin fins and rudders. The fuselage structure will consist of two main sections, that forward being a steel-tube truss layout with an aluminium alloy cabin shell, and that aft being of semi-monocoque construction. The wing will be of metal, with two main panels bolted directly to the fuselage truss—thus doing away with the centre section.

The machine will be produced in two forms, one for private ownership with plenty of room for five persons, and the other for feeder airline work with accommodation for a pilot and five passengers. The main luggage compartment will be located below the rear seats.

Another Birthday

LAST Friday Imperial Airways celebrated their fifteenth birthday with an informal party at which Mr. E. Rawdon Smith, the new public relations officer, made his first official appearance in his work of correlating the company and the public—however this may be done. On this occasion, of course, the existing Press department staff and the multitudinous senior officials of the company were the correlaters.

Pick-up Mail

AFTER a successful demonstration on March 6, the first of the new pick-up mail runs in America was made on March 12. It may be remembered that this system, which was described in *Flight* some time ago, involves the use of a pick-up collection method rather after the manner in which Army Co-operation machines do their specialised work. By such means the need for landing is eliminated, and on the initial services no fewer than fifty-five communities in Pennsylvania, Delawar, West Virginia and Ohio are being served. The machines used are Stinson Reliants, and the actual pick-up system was developed by Dr. L. S. Adams.

Compromise

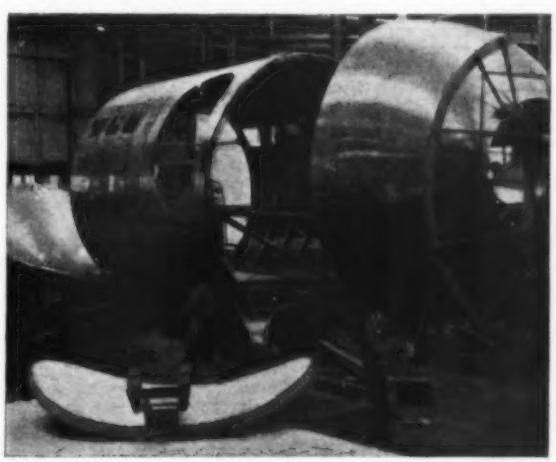
AN ingenious piece of diplomatic compromise lies behind the flight of the *Yankee Clipper* from Baltimore to Europe. Some weeks ago people were speculating as to whether America's first North Atlantic flight this summer would be made to France or to England.

The point was regarded as important, because, if France were chosen as the terminus, Britain might not be able to fly to New York, while, if England were selected, France might be precluded from doing so. The reason for this awkward situation was the reciprocal basis of the terms on which America was prepared to let the flying boats of other countries descend in American waters. According to these terms no country could make transatlantic flights to America unless America also sent her flying boats to that country.

Early in March Pan-American Airways signed an agreement with Air France-Transatlantique for reciprocal flights between France and New York, and it looked as if Britain was going to be left out. It was even said that the Imperial Airways boats would have to be content with a service to Montreal.

Representations were made and the Americans decided to solve the problem by flying to both countries on the same journey. Thus the French are talking of the America-France flight while we are calling it the America-England flight. Both are satisfied, and both countries will be able to fly to America this year.

Actually, preference was shown by P.A.A. for the Azores route because of the better weather conditions prevailing along it, and that is why the original intention was to reciprocate with Air France-Transatlantique—who also show a preference for this route.



PRESSURE CABIN EXPERIMENTS: For some time General Aircraft have been working on pressure cabin problems, and above is the special pressurised section of a fuselage for an S.T.25 which is nearing completion. An auxiliary petrol engine, actually an Aero Engine Sprite, with a blower, is to be used to maintain sea-level pressure up to 15,000ft., with a progressive rate of production above this height. The experiment should be particularly useful in settling structural design problems, especially those relating to windscreens and doors.

Commercial Aviation

LARGE-SCALE MAINTENANCE

Original Ideas in the British Airways Shops at Heston : Scientific Airline Operation : Slots for Fourteens

NOWADAYS it is the necessary custom of air transport operating concerns to carry out all their own maintenance, servicing, rebuilding and testing both of machines and engines. Quite apart from the fact that aircraft and engine factories are not always conveniently placed in relation to transport operating centres, it is obviously necessary for each operator to know all about, and to be sure of, the condition of each of the machines in service, and only through a very carefully organised maintenance and engineering department is it possible for a fleet to be run day in and day out to schedule. Even when reserve machines are available, it is absolutely essential to plan the operations so that the machines can go into the shops for attention without the possibility of interfering with the schedules.

In the past few years British Airways, though a young company, has developed an engineering department which, though comparatively small, is as well organised as any in this country and Europe, and, starting comparatively late in the life of commercial aviation, the company has been able to benefit from the experience of others. Two years ago, when the operations were carried out from Gatwick, we were duly impressed by the way in which the work was done, and after many vicissitudes (which are not yet over, since the services have recently had to be run from Croydon, to the misery of the operational and traffic department), the engineering side, at least, has been able to settle down finally in a definite spot and to organise both for the present and the future.

This department comes under the heading of "Operations," which have, until his transference to Imperial Airways, been under the guidance of Mr. A. C. Campbell Orde, while the chief engineer, who has been responsible for the detailed organisation and for many of the incidental testing and other devices that have been evolved, is Mr. C. T. S. Capel. In due course we hope to describe in detail the shops, the research departments and the operations department as a whole, but for the moment it is possible to give an idea of the work and organising effort which has been put into the big hangar at Heston. Needless to say, the maintenance work both of air frames and engines is "tidied" by means of a carefully devised flow system from shop to shop, and the most strict and scientific tally is kept on the life and behaviour of every part.

Special Test Equipment

But by far the most interesting feature of the shops is the way in which special test tackle has been virtually invented by the company for use in the work of maintaining the fleet—which at present consists of seven Lockheed Fourteens, six Lockheed 10As (or Electras) and three Junkers Ju.52s which are used for the night mail run to Berlin. Actually, the Heston shops turn out from five to seven overhauled engines a month and this feature gives an idea of the work which has to be done—particularly when it is remembered that each of the engines has something like 1,000 working parts, every one of which must be inspected.

Among the items actually evolved by the engineering departments have been an exhaust gas analyser test panel, an electrical test panel, a hydraulic airscrew testing device, and a mobile trolley, with pumps and gauges, for ground-testing the various hydraulically operated items such as retractable undercarriages, flaps and automatic pilots. Additionally, the department has also invented a simple hydraulic method by which the engine crankshafts may be assembled and disassembled—thus doing away with the necessity for violent and metallurgically dangerous efforts with an extractor and two-foot spanner; a small hand-pump feeds the ram, which forces the two halves of the crankshaft apart or together again.

Among these test rigs the most useful and interesting are those for dealing with the full-feathering Hydromatic airscrews and with the machine's hydraulic gear. In fact, British Airways was, we believe, the first to employ this type of airscrew in Europe, and it was necessary for them, consequently, to develop their own testing system for the purpose of thoroughly trying out the operating mechanism during and after assembly. After overhaul or routine attention, the Fourteens are jacked up and the hydraulic test trolley is used for trying out each of the hydraulically operated items and for making sure that the pipe-lines and valves are working properly.

British Airways' particular experience with Lockheed machines has enabled them to give the manufacturing company in America a number of extremely useful pointers. Not long ago, for instance, they redesigned the wing-tip navigation lights of the Fourteens after it had been found that the standard cylindrical type of light interfered considerably with the airflow at comparatively low speeds. More recently they have been in process of modifying all the fleet of Fourteens by the application of what amounts to a fixed slot. This takes the form of a pair of channels at each wing-tip, these connecting the upper and lower surfaces and having the effect of cutting the tip away from the rest of the wing (when viewed in theoretical cross-section). It has been found that this slot system not only prevents premature wing-tip stalling, but also provides much more adequate aileron control at and near the stall.

When the modified Fourteens are again in service it will not be necessary for them to be brought in with such an ample reserve of speed, nor to be held down very carefully during the take-off. Curiously enough, any take-off difficulty is a matter rather of low power-loading than of high wing-loading. Except when fully loaded, the Fourteen is so adequately powered during the take-off that there is a considerable tendency for the machine to fly prematurely "on its engines" and before it has actually obtained adequate flying speed; consequently at that moment, there is sometimes a tendency for one or other wing to stall accidentally. We understand that the military versions of the Fourteen, which will be known in service as the Hudson, are being similarly modified.

Operational

Under the general heading of operations are those most important departments dealing with the navigation arrangements, training, and research work for the development and practical application of new ideas. The last is in charge of Mr. R. A. Hall. Here the visitor finds such semi-secret items as instrument layout drawings for the Fairey F.C.1 transport, the design of which was largely based on the requirements of British Airways.

In the map department special maps and charts are drawn out, with the appropriate tracks, for use by the pilots on the different services. That used in normal routine is a one-piece affair on which, as previously described in *Flight*, the different D/F stations have press-stud fittings by which a pair of transparent arms can be attached for laying off the appropriate bearings. When flying under cloud and in view of the ground specially laid out larger scale maps are used.

In the map department, too, the route instruction books, which are carried on each machine, are made up from the innumerable items of navigational information. At the moment, the department is making up smaller versions of these books wherein the pilot can find all the absolutely essential information without too much delay. While the larger books, which are carried in a special map case, give all possible information, the smaller "emergency" books will be concerned largely with the layout of different aerodromes on the routes in relation to the direction-finding, lighting and blind approach equipment provided.

More Wireless Trainers

IN addition to the two De Havilland 86B machines which were supplied last year to the Royal Air Force for wireless instructional work at Cranwell, the Air Ministry has now ordered three D.H. Rapides for similar duties. These are additional to the two 86Bs and the two Rapides which have been used for communication work during the last year.

Safely Across

AFTER reaching Horta, in the Azores, as recorded in last week's issue, the Boeing 314, *Yankee Clipper*, left for Lisbon on Thursday morning and covered the 1,100-mile second stage of the Atlantic crossing in just over seven hours.

On Sunday the machine left the Tagus Estuary for Marseilles, but, apparently, because of bad weather at that terminal, Capt. Gray, who is in command, put down at Biscarosse, near Bordeaux, 4½ hours after leaving Lisbon. By now the machine may have duly arrived at Southampton.

The second of the big Boeings, *Atlantic Clipper*, was put on the Bermuda service for the first time on Wednesday of last week—the day after that on which *Yankee Clipper* had reached Horta.

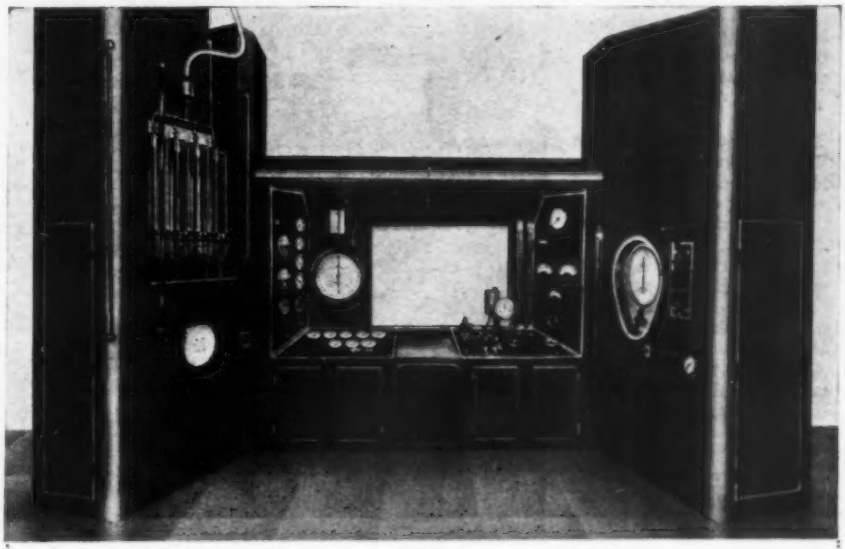
FOR ENGINE RESEARCH

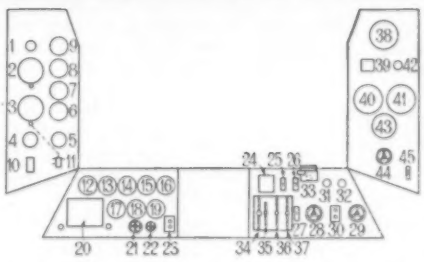
Notable Features of Electro - hydraulic Dynamometer Plant by Heenan and Froude

A DYNAMOMETER plant specially designed for research and development work has been evolved by a well-known firm of specialists in such equipment, Heenan and Froude, Ltd., of Worcester, and an example has been shipped to Soviet Russia following an order given by the U.S.S.R. Trade Delegation. The firm, incidentally, has already supplied a number of more orthodox aero-engine dynamometer plants to Soviet Russia.

Basically, the equipment is similar to that supplied for production testing in a number of aero-engine factories in this country, but there are a number of outstanding differences designed to facilitate research work.

Most notable of these, perhaps, is the fact that the dynamometer is of the electro-hydraulic type as opposed to the purely hydraulic. Secondly, the hydraulic unit is not controlled by sluice gates between the two rotating elements; instead, there is an ingenious system of varying the amount of water in circulation between the pockets of the elements. Thirdly, petrol consumption data can be recorded by weight as well as by the more usual flowmeter method. Fourthly, the major part of the weighing gear for recording load is housed in the engine test room and not in the control room; only a slender rod connects the weighing gear with the indicating dial, so that the sound-proofing of the control room is greatly simplified. All control and recording gear is brought into the control room, so that the staff can work in quiet conditions and need only enter the test room for preliminary setting-up and eventual disconnection. Cooling air is supplied via a tunnel by a fan driven by a 975 h.p. motor which can deliver a blast of a velocity up to 400 km./hr. or 250 m.p.h.





The control panel for the electro-hydraulic dynamometer plant. A key to the items on the desk appears below. On the wall to the left of the desk are the fuel flowmeter columns and controls and on the right-hand wall are the various indicators and controls associated with oil-consumption measurement.

1. Detonindex.
2. Depth gauge, overhead water tank.
3. Litres of fuel in tanks.
4. Air-speed indicator.
5. Air-speed indicator.
6. Air temperature in tunnel.
7. Air temperature (depression).
8. Mixture temperature between carburetter and supercharger.
9. Mixture temperature after supercharge.
10. Falling water pressure engine cut-out switch.
11. Manifold to three petrol tanks for gauge Mk. III.
12. Oil temperature, L.H. oil tank
13. Oil temperature, R.H. oil tank.
14. Oil pressure, oil cooler by-pass.
15. Engine oil pressure, outlet.
16. Engine oil pressure, inlet.
17. Fuel pressure.
18. Engine oil temperature, outlet.
19. Engine oil temperature, inlet.
20. Thermocouple pyrometer.
21. Oil-cooler water, coarse control.
22. Oil-cooler water, fine control.
23. Dynamometer valve control.
24. Automatic throttle switch
25. Master ignition switch.
26. Coil ignition switch.
27. Magneto ignition switch
28. Shunt regulator
29. Potentiometer regulator.
30. Starting motor, start-stop buttons.
31. Load indicator lamp.
32. Starting motor indicator lamp.
33. Tachometer.
34. Throttle control.
35. Throttle control reset lever.
36. Magneto control
37. Altitude control.
38. Revolution indicator.
39. Overspeed relay.
40. Main voltmeter.
41. Main ammeter.
42. Reversing switch for item 38.
43. Exciter voltmeter.
44. Exciter regulator.
45. Desk light switch.

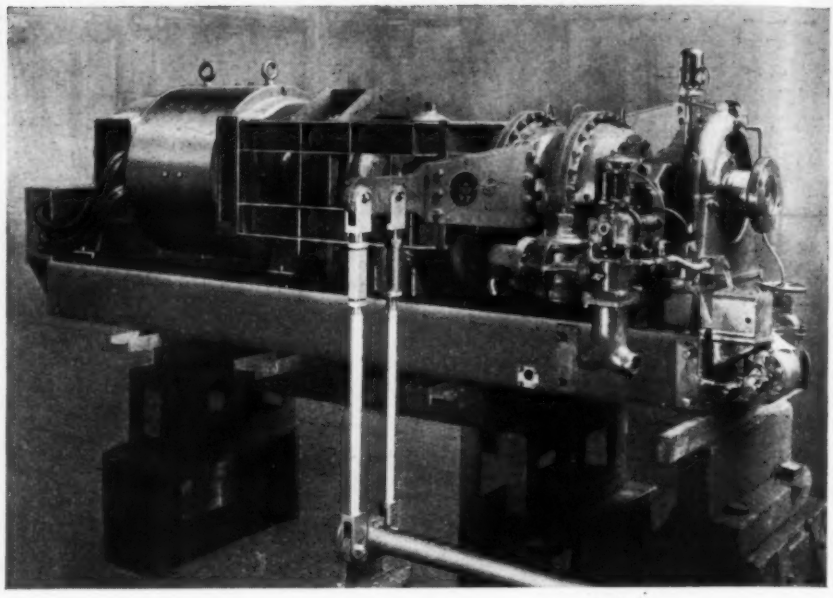
In the combined electric and hydraulic system the casing of the electrical element is linked up as a unit with that of the hydraulic unit. The armature shaft is connected to the shaft of the hydraulic unit through an electro-magnetic clutch so arranged that connection cannot be made until both shafts are at rest. When the starter button is pressed the clutch engages while the water supply to the hydraulic unit is cut off and the casing is drained. Motoring tests can then be conducted, the torque-reaction weighing mechanism indicating the torque entering or leaving the output shaft of the combined dynamometer; thus, internal losses do not affect the accuracy of measurement.

The electric unit is a D.C motor with a capacity of either 340 b.h.p. at 2,500-1,500 r.p.m or of 340-113 b.h.p. at 1,500-500 r.p.m., according to which of two control systems is being used.

When it is desired to make a change-over from motoring to power absorbing the aero engine is set to start on a small throttle opening; the magnetic clutch automatically disengages and shuts down the electric motor, the water supply to the hydraulic unit being restored at the same time.

The system of controlling the amount of water in the pockets of the dynamometer is extremely ingenious. In dynamometers in which the water outlet is controlled by hand, increased speed tends to pump the casing dry and so allow the engine to race, while, conversely, a temporary reduction in speed will cause the casing to fill and the engine to labour.

If, on the other hand, the volume of water is kept constant under all speed conditions, then the dynamometer load will follow a well-known hydraulic law, i.e., if the water pressure varies as the square of the speed, then the torque absorbed by the dynamometer varies as the square of the speed of its shaft. Conversely, provided that the water pressure varies as the square of the speed, then its quantity will remain constant despite alterations in speed; thus, the torque absorbed by the dynamometer will vary as the square of the speed. [*Cont. overleaf*]



The electro-hydraulic assembly with the electric unit on the left, the magnetic clutch in the centre, and the hydraulic unit to the right. Connections to the weighing gear are seen in the foreground.

This basic principle is utilised in the control system adopted in the Heenan and Froude design. Very briefly, a pump driven from the dynamometer shaft delivers oil from an expansion chamber to the high-pressure side of a pressure-difference cylinder containing a flexible diaphragm.

Oil returns to the expansion chamber by flowing from the high-pressure chamber to the low-pressure one via a controllable by-pass, thus creating a pressure difference that tends to thrust the diaphragm downwards. The diaphragm is connected with the water outlet valve, and the force actuating the valve is thus varied as the square of the speed of the dynamometer shaft at any setting of the control valve. Very accurate control and inherent stability are thereby ensured.

Fuel flow is measured by four Amal flowmeters and, as already mentioned, there is also a method of direct measurement of fuel consumption by weight. This depends on a simple system utilising a mechanically balanced reservoir which, through levers, operates a rotating disc. In this disc are two slots which admit light to a photo-electric cell in circuit with a stop-clock. Movement of the reservoir under the influence of fuel load is thus automatically and accurately timed. Oil is weighed by a Salter weighing machine which carries the main oil tank.

The auxiliary installation—water supply tanks, air shafts, control-room equipment—are as thoroughly planned.

Ten Thousand Air Defence Cadets

THE Air League of the British Empire announced this week that the Air Defence Cadet Corps is now more than 10,000 strong—a figure which represents 100 squadrons.

The essence of the A.D.C.C. scheme is that each squadron should be self-supporting with the aid of local subscriptions and the Air Ministry's capitation grant of 3s. 6d. Grants come from a Central Fund, to which Lord Nuffield subscribed £10,000 and which was raised to £25,000 following the recent gift of £2,401 by Mr. Simon Marks.

* * *

Cadets of the 39th (Barnes and Richmond) Squadron of the A.D.C.C. recently heard the first of a new series of lectures arranged in conjunction with specialists in aeronautical equipment. F/O. H. Ellison, R.A.F.O., spoke on "Ice Formation and the B.T.R. Mechanical De-icer."

* * *

Ex-R.A.F. personnel are required as officers for the A.D.C.C. squadron formed at Ruislip, Northwood. Application should be made to Mr. H. E. Francis Stead, 3, Greencroft Avenue, Eastcote, Ruislip.

Instructive Entertainment

LATEST of the usually highly credible American flying films to entertain London audiences is *Wings of the Navy*, which opened last week at the Warner Theatre, Leicester Square.

In many ways it is the best of the bunch, combining a stock story with excellence of photography and a pervading air of authenticity.

Of particular interest are the training sequences, which show student pilots of the U.S. Navy receiving instruction on little single-float seaplanes, the identity of which, by the way, will baffle most people. Actually, they are Whirlwind-engined primary trainers of official design built at the Naval Aircraft Factory, Philadelphia. There are some fine incidental shots of formations of Boeing single-seater fighters (including a dive bombing "peel off," which is, to our mind, the most effective of manœuvres when seen on the screen) and the training of the hero culminates in flights with the impressive Consolidated PBY twin-engined long-range flying boats, providing some first-rate interior and take-off "shots" from which a good idea can be gained of how these fine craft are operated and handled. The retraction of the wing-tip floats will especially interest the technician.

Forthcoming Events

APRIL.

Sat.,	15th.	Opening of West Hartlepool Airport by the Secretary of State for Air.
Fri.,	21st.	Norfolk and Norwich Aero Club: Annual Dinner and Dance.
Sat.,	22nd.	Aero Golfing Society: Match v. R.A.F., Martlesham and Felixstowe.

MAY.

Thurs.,	4th.	R.Ae.S. Lecture*: "Strength of Thin Metal Construction," by H. L. Cox.
Fri.,	5th.	Official opening of Guernsey Airport by Sir Kingsley Wood.
Sun.,	14th.	R.Ae.S. Garden Party, Fairey's' Great West Aerodrome.
Tues.,	16th.	Aero Golfing Society "Flight" Trophy, Wentworth.
Sat.,	20th.	Empire Air Day.
Thurs.,	25th.	R.Ae.S. Wilbur Wright Memorial Lecture by Dr. G. W. Lewis.
Sat.,	27th.	London-I.O.M. Race.
Mon.,	29th.	Manx Air Derby and Tynwald Race.

JUNE.

Sat.,	10th.	Brooklands Flying Club "At Home."
Sat.,	17th.	Official opening of Derby Municipal Airport (Burnaston) by Sir Kingsley Wood.
Wed.,	21st.	Aero Golfing Society: Jubilee Cup, Berkshire Golf Club.
Sat.,	24th.	Royal Air Force Garden Party.

JULY.

Sat.,	8th.	Official Opening of Birmingham Airport (Elmdon) by H.R.H. the Duchess of Kent.
Sat.,	8th-Sun., 23rd.	Brussels Aero Show.
Sat.,	15th.	Gosport Reunion, Brooklands.
Sat.,	29th-Sun., 30th.	Frankfurt International Flying Meeting.

AUGUST.

Sat.	12th.	Eastbourne Flying Club: Flying Display and Garden Party.

* All these lectures take place at 6.30 p.m. at the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

THOSE LANDING FEES

A Lympne Experience

MAY I through the medium of your columns lodge a protest against the imposition of landing fees at certain aerodromes, notably those run by the Government?

I recently had cause to land at Lympne on a trip on which I was in the air for 1¼ hours, using approximately 7 gallons of petrol on which the State gets a tax return of 4s. 8d. On landing I was promptly seized by upwards of half a dozen officials and escorted to an office where I was made the richer by one printed form (C.A. form 10) and the poorer by 3s. 6d.

On taking off from the same aerodrome I was forced to start up my own machine without chocks and without anybody at the controls.

Seeing that the Government is trying to encourage private and club flying by subsidies to bring down the cost to a few shillings an hour, the charge of such a landing fee, coupled with the utter lack of service, seems to be absurd.

Ditchling, Sussex. F. FOSTER (Eastbourne F.C.).

THE EMPIRE AIR DAY POSTER

A Criticism

I WONDERED if you had noticed that once again the organisers of the Empire Air Day poster competition have accepted an unauthentic painting. The machines are presumably Hurricanes, but the cocades on the underside of the wing are outlined with a yellow ring. Since the undersides of fighters are silver, the cocades should *not* be outlined at all. This is a common mistake amongst aeronautical artists, and I think the Air League of the British Empire should exercise more care to take authenticity into consideration when judging posters.

Last year's effort, as *Flight* remarked, was a disgrace.

Warrington, Lancs. O. G. THETFORD.

[We feel that our correspondent is a little hypercritical of an otherwise very effective drawing. Incidentally, quite a number of R.A.F. fighters now have the underside of one wing painted black and the other white.—ED.]

AERODROME SITES

—And the Price of Them

AS the British public's "airmindedness" increases, so, it seems, do the difficulties that beset the would-be aerodrome-owner in his search for a suitable site!

And even when he is fortunate enough to locate a ground both eligible for an Air Ministry licence and near to a promising centre (no easy task in these days of housing expansion), the price that owners demand for such land is usually exorbitant.

I wonder whether there is no means of checking this ever-increasing "racket"? I should be only too glad to hear that there *does* exist some society to further the interests of the aerodrome-seeker, or to hear of any "non-racketeers" willing to sell. D. DAVIES.

Wells, Somerset.

MERELY A LINK

The Ground Radio Operator Talks

THERE is no doubt that many people have read Mr. George F. Yuill's most interesting and instructive article, headed "QBI and Why," and published in *Flight* of March 16. Quite a number of them will thus have been introduced to little details of which they had no previous knowledge, or to which they had given very little thought. Of a certainty, the result will be that greater care is taken in future when QBI conditions prevail.

There is reason to regret, however, that Mr. Yuill had not the time (or the space) to introduce one man to whom much greater consideration should be shown, not only in QBI, but at all times—the man who has to bear the brunt of the idiosyncrasies of inconsiderate aircraft commanders, of the thoughtlessness and carelessness of selfish air radio operators, and of the over-zealousness of highly strung A.T.C.O.s—the ground-station radio operator.

The first are apt, very often, to believe that they are the only people flying; the second seem, at times, to expect the ground man to read their minds rather than their morse; the third thinks he is not doing his work properly unless he is ensuring an unpunctuated "running commentary" from ground to air. Add to these difficulties the QRM conditions on the aircraft waves and the evil of bad static conditions, bearing in mind that the ground man cannot ask, "QAR?" The resultant gives the position *without* QBI.

In QBI the bad static conditions are, fortunately, very rare, but they are replaced in full by the additional number of communications, addressed not only to and from the ground station under consideration, but to and from perhaps half a dozen more, all willing and anxious to give their best possible service to the aircraft which they serve.

It is not difficult to realise that if the ground-station operator were to "crack" under these conditions the highly organised Control department would become inoperative. He does *not* crack, of course; in fact, of all concerned, he is probably the coolest and most efficient man at his job. His is the hand on the "gonio" and his the responsibility for the accuracy of bearings, and, QRM or no, he must give bearings upon which a pilot can rely. QDMs at the rate of three a minute—no unusual figure—with the knowledge that several other machines are awaiting his assistance, is no joke. Can an operator be blamed for a little exasperation if, as Mr. Yuill says, someone asks "QTR?" in the middle of it, if he has to ask for a repetition of a "QGV QFG QAL" because of a careless transmission of it, or if a Control chit is pushed under his nose requesting some irrelevant or, at the moment, unnecessary information?

A prominent official recently described the ground radio staff as "merely a link." A day in the radio office of an area station would show that it is the whole chain—a very efficient, conscientious, patient, courteous and ill-appreciated chain.

In spite of the foregoing remarks, it must be admitted that many pilots, air operators and A.T.C.O.s think that the "Reglements" is quite a good idea. TELE.

Lancs.

FOR BALLOON ENTHUSIASTS

A Chance to Get Together

THE Air League of the British Empire, which exists for the advancement of British aeronautics, desires to form a lighter-than-air branch. The object of this branch is to band together in one organisation all those who have served, or who are serving, with airships or balloons, or whose interests lie in aerostation as distant from aviation.

With the formation of the Balloon Barrage Squadrons of the Auxiliary Air Force, the time seems opportune for this move, and it is hoped that all lighter-than-air men will come forward to support this effort. All interested are invited to write to the Air League of the British Empire, Maxwell House, Arundel Street, London, W.C.2.

Unity is strength, and it is quite possible that if such an organisation had been formed at the end of the war, British airships would still be flying and a larger reserve of experienced personnel would be in existence, which would have been of assistance to the Balloon Barrage. VENTRY,

London, W.C.2. H. DELACOMBE,
J. S. WHEELWRIGHT,
J. G. HUDSON.

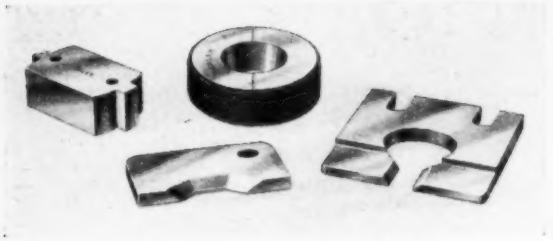
CONTROL AXES

An Author's Amendment

I SHOULD like to amplify the reference I made to the American "slot-lip" aileron in my article in *The Aircraft Engineer* supplement to *Flight* of March 23. The general shape of the curve is similar to the spoiler curve, but the control does not suffer from "lag" to any serious extent, whereas the spoiler is spoilt by this. The slot-lip aileron does suffer from a noticeable "sluggishness" in developing its full rolling power, however, and it also involves a serious drag due to the hole in the wing, which reduces the rate of climb very badly. For these reasons and because of its excessive yawing moment when used at high speed it falls far short of an ideal lateral control. I regret that I did not make this more clear.

I must also correct some misleading wording in Fig. 3, where the inertia ratios are shown as being wing:body ratios; they are, of course, body:wing ratios, as should be clear from the text. W. E. GRAY.

Edgware.



THE INDUSTRY

Air Minister at Speke

SIR KINGSLEY WOOD, Secretary of State for Air, was due to make a visit last Monday afternoon to the aircraft shadow factory at Speke, Liverpool, operated by Rootes Securities, Ltd.

Sir Kingsley was to be accompanied by his Parliamentary Private Secretary, Sir Edward Campbell, M.P., and by Maj. B. W. Shilson, Assistant Director of Aircraft Production.

New Short Venture

THE registration is recorded, on March 28, of a new company under the title of Kent Alloys, Ltd. The nominal capital is £100,000, and the directors are Mr. H. O. Short, Mr. Arthur Gouge and Mr. J. H. Wood.

Objects are stated to be "to carry on the business of engineers, founders, smiths, machinists, manufacturers of and dealers in engines and machinery, aeroplanes, seaplanes and aircraft of all kinds, works contractors, etc." The registered office is at 41, Whitehall, London, S.W.1.

Test-Pilotage

MR. R. LINDSAY-NEALE, of Lindsay-Neale Aviation, Ltd., 4, Park Lane, London, W.1, states that he is now in a position to undertake test, delivery or demonstration flying for manufacturers or for intending purchasers of aircraft. During the past nine years he has flown 1,200 hours on more than 70 types of single and multi-engined machines.

Another Works Band

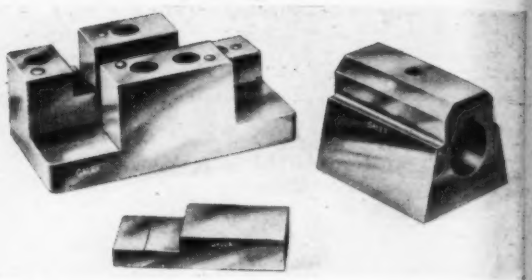
FOLLOWING our publication of a photograph of the Fairey Stockport Works band—claimed to be the first aircraft works band—Mr. G. H. Dowty tells us that Aircraft Components, Ltd., have a band, twenty-three strong, which was founded in March, 1937. Uniforms are green with gold facings and, to judge from a photograph, the turnout is a thoroughly smart one.

Seeking Independence

FOR several years R. B. Pullin and Co., Ltd., of Phœnix Works, Great West Road, Brentford, have been dependent on outside sources for certain materials necessary for the production of bearing sights and other types of precision-made instruments in which the company specialises.

With the object of overcoming these difficulties a new company has been formed, to be known as the Pullin Optical Co., Ltd. The directors are Mr. R. B. Pullin, Mr. P. J. Ellis and Capt. A. Frazer-Nash. A site in Lane End, High Wycombe, covering an area of 20,000 sq. ft., has been selected and the factory, which is nearing completion—it is hoped to start production in June—is designed with an eye to expansion to the extent of four and even five times its original size. It is intended that the new company shall manufacture every component necessary in the wide range of scientific optical instruments which will be produced on a large scale.

Designed to fit all diameters, the Beru hose clip, with screw tensioner, can be supplied with 5 mm. or 9 mm. ribbons. On the right is the latest Beru aviation sparking plug, with screened adaptor, made by Beru-Werk Albert Ruprecht, Ludwigsburg, Germany.



FOR ACCURACY: Receiving, position and slip gauges—a few of the many types of precision gauge made for the aircraft industry by George H. Alexander Machinery Ltd., Birmingham, 4. The production of these gauges includes inspection by light-projection methods which will detect errors of 0.00001 in.

AERONAUTICAL PATENT SPECIFICATIONS

(*Published March* 9, 1939.)

10719. Hamburger Flugzeugbau Ges., and Vogt, R.: Aeroplanes (500,541).
12923. Bendix Aviation Corporation: Magneto generators (500,347).
15562. Sperry Gyroscope Co., Inc.: Electric signalling and/or control systems (500,468).
21634. Dowty, G. H.: Control of fluid-operated systems, particularly for aircraft (500,477).
21796. Marconi's Wireless Telegraph Co., Ltd., and Cockerell, C. S.: Direction-finding radio receiving installations (500,481).
21798. Marconi's Wireless Telegraph Co., Ltd., and Cockerell, C. S.: Navigation-aiding radio systems (500,359).
22209. Onions, J. H., and Ribbesford Co., Ltd., Shock-absorber struts for aircraft (500,574).
22355. Marconi's Wireless Telegraph Co., Ltd., and Plaistowe, D. L.: Radio apparatus for detecting aircraft (500,588).
22489. Yoxall, J., and Propello Inventions, Ltd.: Revolving cylinder fluid pump or motor (500,299).
22812. Jeffcock, J. P.: Cathode-ray radio direction-finding apparatus (500,592).
24611. General Electric Co., Ltd., and Barsdorf, L. W.: Electric boundary lights for aerodromes (500,595).
31578. Arado Flugzeugwerke Ges.: Controlling hydraulically-actuated devices (500,500).
21279. Telefunken Ges. fur Drahtlose Telegraphie: Radio direction-finders (500,526).
21660. Junkers Flugzeug-und-Motorenwerke Akt.-Ges.: Masts for mounting wireless aerials on aircraft (500,528).
27120. Aubarede, P. C. A. M. D': Elastic mountings for engines carrying airscrew propellers (500,538).
30418. Telefunken Ges. Fur Drahtlose Telegraphie: Radio direction-finding systems (500,345).

(*Published March* 23, 1939)

10949 Siemens Apparate und Maschinen Ges.: Automatically operated variable-pitch air propellers (501,054)
10950 Siemens Apparate und Maschinen Ges.: Automatically operated variable-pitch air propellers (501,127)
20336 Langley, T. W., and Tecalemit, Ltd.,: Means for detecting ice-forming conditions particularly when encountered by aircraft (501,201).
23050. Supermarine Aviation Works (Vickers) Ltd., and Smith, H. C.: Construction of wings for aircraft (501,281).
23107. Bronzavia Soc. Anon: Gas-dispensing apparatus, especially for aircraft (501,138).
23809. Leichtflugzeugbau Klemm Ges., Klemm, H., and Schopper, K.: Two-stroke internal-combustion engines (501,213).
27075. General Electric Co., Ltd., and Barsdorf, L. W.: Wind direction indicators (501,373).
27903. Fairey Aviation Co., Ltd., Dunsford, C. G. J., and Hetherington, J.: Means for hoisting torpedoes, bombs and the like into a required position for stowage or launching (501,302).
35004. Metalastik, Ltd., and Goldschmidt, M.: Elastic mountings for instruments and machine units (501,167).
10873. Henschel Flugzeug-Werke Akt-Ges.: Presses for the production of sheet metal pressings (501,235).
17798. Telefunken Ges. Fur Drahtlose Telegraphie: Direction-finders (501,248).
23989. Daimler Benz Akt.-Ges.: Cooling of internal-combustion engines (501,257).

(*Published March* 30, 1939)

23434. Bruyne, N. A. de, Aero Research, Ltd., and De Havilland Aircraft Co., Ltd.: Production of reinforced synthetic resin material or objects (501,649).
23553. Bendix Aviation Corporation: Carburetters for internal-combustion engines (501,650).
23554. Bendix Aviation Corporation: Carburetters for internal-combustion engines (501,651).
24228. Marconi's Wireless Telegraph Co., Ltd., and Vallette, T. A.: Navigation aiding directional radio receiving systems (501,550).
27242. Fairey Aviation Co., Ltd., and Lobelle, M. J. O.: Aircraft wing flaps (501,463).
31356. Traversi, R. A., and Studi E. Brevetti Gruppo Caproni: Gun barrels for ordnance (501,777).
32246. Exactor Control Co., Ltd., and Dwerryhouse, P. J.: Engine controls particularly for aircraft engines (501,622).
34174. Voith, W., Voith, H., and Voith, H. (trading as Voith, J. M. (Firm of)): Blade wheel propellers (501,467).
2282. Hovland, A. N.: Flying-machines (501,472).
9476. Fairey Aviation Co., Ltd., Lobelle, M. J. O., and Huxley, M. F.: Control mechanism for aircraft (501,699).
16284. Ascanelli, A., and Zambaldi, E.: Dual controls for aircraft (501,494).
17763. Arado Flugzeugwerke Ges.: Cowling for aircraft engines or for radiators or the like for aircraft engines (501,789).
25003. Dewandre, A.: Hydraulically and pneumatically controlled turrets for automatic guns (501,503).
33175. Brewer, G. (Krupp Akt.-Ges., F.): Armoured turrets or cupolas (501,792).

WARNING!